KEY

TO

GRADUATED EXERCISES

IN

ARITHMETIC AND MENSURATION.

KEY

GRADUATED EXERCISES

ARITHMETIC AND MENSURATION.

———◆◇◆———

EXERCISE I.

(1)...
```
      20020020
         19037
        207500
       7000309
         10001
      ─────────
      27256867
```

(2)...
$$\text{hf. cr. } 19 \times 30 \times 4 = 2280 \text{ far.}$$
$$\text{fl. } 17 \times 24 \times 4 = 1632$$
$$\overline{3912} \text{ far.}$$

(3)...
```
      t.  cwt. qrs. lb.  oz.
      17   13   2   11   13
      20
     ────
      353
        4
     ─────
     1414
       28
     ─────
    11323
     2828
    ──────
    39603
       16
    ──────
   237631
    39603
   ───────
   633661 ounces
```

(4)...
```
      lb.  oz.  dwt.
       7   11    17
      12
      ───
      95
       20
     ─────
     1917
       24
     ─────
     7668
     3834
     ──────
    46008 grains
```

(5)...
```
      E. ells qrs.
      17    3
       5
      ───
      88
       4
      ────
      352 nails
```

           mi. fur. yds.

(6)...   13   7   173   (7)...

13 7 173	July contains 31 days
8	August „ 31
111	Sept. „ 30
220	Oct. „ 31
2393	Nov. „ 30
222	Dec. „ 31
24593	184
3	24
73779	736
12	368
885348 inches	4416
	60
	264960 min.

	£	s.	d.			s.	d.	
(8)...37 gui. =	38	17	0	(9)...		17	9¾	=855 far.
19 sov. =	19	0	0		£82	16	6¾	=79515 far.
37 hf. cr. =	4	12	6					
33 fl. =	3	6	0		79515÷855=93 times			
79 sh. =	3	19	0					
	£69	14	6					

(10)...   3¾ yds. = 15 qrs.

                         56¼ yds. = 225 qrs.

                225÷15 = 15 shirts

EXERCISE II.

(1)...   See " *Answers.* "

        gui.

(2)...   7897 × 21 × 12 × 4 = 7960176 farthings

      hf. cr.   oz.   dwt.

(3)...   14   (4)...   119   17

        30   20

4)420   2397

     105 fourpenny-pieces   24

                                      9588

                                  4794

                                 57528 grains

(5)...
```
         inches
   12)2914367
    3) 242863   11 in.
        80954   1 ft.
            2
```
$5\frac{1}{2} \times 2 = 11\overline{)161908}$
```
        40)14718   10 hf. yds. = 5 yds.
         8) 367    38 poles
            45     7 fur.
```

(6)...
```
   qrs.  bu.  pks.
    27    5    3
     8
    221
     4
    887
     2
    1774 gallons
```

Ans.   45 mi. 7 fur. 38 po. 5 yds. 1 ft. 11 in.
        = 45 mi. 7 fur. 39 po. 5 in.

(7)...
```
   60)139292 min.
   24) 2321  32 min.
    7)  96   17 hrs.
        13    5 days
```

(8)...
```
                £   s.  d.
   33 hf. gui. = 17  6   6
   119 hf. cr. = 14  17  6
                £2  9   0
```

Ans. 13 wks. 5 days 17 hrs. 32 min.

(9)...
```
   £   s.  d.
   19  17  6¾
           4 × 7 + 1 = 29
   79  10  3
           7
   556 11  9
   19  17  6¾
   £576 9  3¾
```

(10)...
```
   £    s.  d.
   17   16  6
   20
   356
      d.  12
   7s. 9d. = 93)4278(46 yards
            372
            558
            558
```

EXERCISE III.

(1)...
```
      437 divisor
      129 quotient
     3933
      874
     437
        78 remainder
     56451 dividend
```

(2)...
```
      735 fourpences
        4
   30)2940
        98 half-crowns
```

(3)...   27½ guineas   (4)...   16)1000000 ounces
                    2   28) 62500
                ‾‾‾‾   ‾‾‾‾‾‾‾‾
                55 half-guineas   4) 2232   4 lb.
                21   ‾‾‾‾‾‾‾‾
                ‾‾‾‾   20) 558   0   4
                55   ‾‾‾‾‾‾‾‾
                110   27 18   0   4
                ‾‾‾‾‾   *Ans.* 27 tons 18 cwt. 4 lb.
                1155 sixpences

	lb.	oz.	dwt.	grs.
(5)...	75	7	19	17
	12			

907
 20
‾‾‾‾‾
18159
 24
‾‾‾‾‾
72653
36318
‾‾‾‾‾
435833 grains

	ac.	ro.	po.
(6)...	11	3	25
	4		

47
40
‾‾‾‾
1905
 30¼
‾‾‾‾‾
57150
476¼
‾‾‾‾‾
57626¼ sq. yds.

                                    days
(7)...   June contains 30   (8)...   1 mile = 5280 feet
         July   „   31   87
         August   „   31   ‾‾‾‾‾
         Sept.   „   30   36960
                       ‾‾‾‾   42240
                        122   31680)459360(14 ft. 6 in.
                         24   31680
                       ‾‾‾‾   ‾‾‾‾‾‾
                        488   142560
                        244   126720
                       ‾‾‾‾   ‾‾‾‾‾‾
                        2928   15840
                         60   12
                      ‾‾‾‾‾‾   ‾‾‾‾‾‾
                      175680 minutes   31680)190080(6 in.
                                                    190080
                                                   ‾‾‾‾‾‾

$$\text{(9)}\ldots 73)\overset{\pounds\quad s.\quad d.}{188\ \ 19\ \ 3\tfrac{1}{4}}(\pounds2\ 11s.\ 9\tfrac{1}{4}d.$$

```
(9)...73)188  19  3¼(£2 11s. 9¼d.
         146
         ‾‾‾
          42
          20
      73)859(11s.
         803
         ‾‾‾
          56
          12
      73)675(9d.
         657
         ‾‾‾
          18
           4
      73)73(1 far.
         73
         ‾‾
```

```
                      £    s.   d.
(10)...250 gui. = 262  10   0
                   16    2   6
                  ‾‾‾‾‾‾‾‾‾‾‾‾
                  246    7   6
                   20
            365)4927(13s. 6d.
                365
                ‾‾‾‾
                1277
                1095
                ‾‾‾‾
                 182
                  12
            365)2190(6d.
                2190
                ‾‾‾‾
```

EXERCISE IV.

(1)... See "*Answers*."

(2)...
```
                        s.
        379 gui. = 7959
        219 sov. = 4380
        423 cr.  = 2115
        177 fl.  =  354
        689 sh.  =  689
                  ‾‾‾‾‾
                  15497
                     12
                 ‾‾‾‾‾‾
                 185964
                      4
                ‾‾‾‾‾‾‾
                743856 far.
```

(3)...
```
                gui.
                285
     1 gui. =    42 sixpences
               ‾‾‾‾
                570
               1140
            5)11970
            ‾‾‾‾‾‾‾
               2394 half-crowns
```

(4)...
```
         1964327
              35
   3036)1964292(647 divisor
        18216
        ‾‾‾‾‾
        14269
        12144
        ‾‾‾‾‾
         21252
         21252
         ‾‾‾‾‾
```

(5)...
```
        t.   cwt.  lb.  oz.
        23    13   19   11
        20
       ‾‾‾
       473
       112
       ‾‾‾
       965
       473
       473
       ‾‾‾‾‾
       52995
          16
       ‾‾‾‾‾
      317981
       52995
      ‾‾‾‾‾‾
      847931 ounces
```

(6)...
$$
\begin{array}{cccc}
\text{qrs.} & \text{bu.} & \text{pks.} & \text{gal.} \\
27 & 5 & 3 & 1 \\
\end{array}
$$

$$
\begin{array}{r}
8 \\
\hline
221 \\
4 \\
\hline
887 \\
2 \\
\hline
1775 \\
8 \\
\hline
14200 \text{ pints}
\end{array}
$$

(7)...1 acre = 4840 sq. yds.

$$
\begin{array}{r}
5\frac{1}{4} \\
\hline
24200 \\
1210 \\
\end{array}
$$

$168)\overline{25410}(151\frac{1}{4}$ yds.

$$
\begin{array}{r}
168 \\
\hline
861 \\
840 \\
\hline
210 \\
168 \\
\hline
42 \\
\hline
168
\end{array} = \frac{1}{4}
$$

(8)...
$$
\begin{array}{rr}
s. & d. \\
28 & 9 \\
12 & \\
\hline
345 & \\
13 & \\
\hline
1035 & \\
\end{array}
$$

$$
\begin{array}{cc}
s. \quad d. & d. \quad 345 \\
3 \quad 10 = & 46)\overline{4485}(97\frac{1}{2} \text{ lb.} \\
& 414 \\
& \hline \\
& 345 \\
& 322 \\
& \hline \\
& 23 \\
& \hline \\
& 46 = \frac{1}{2}
\end{array}
$$

(9)...£7 15 $5\frac{1}{4}$ = 7461 farthings

£334 3 $9\frac{3}{4}$ = 320823 farthings

320823÷7461 = 43 times

(10)...
$$
\begin{array}{lrrrr}
& & \pounds & s. & d. \\
7 \text{ sov.} & = & 7 & 0 & 0 \\
19 \text{ hf. sov.} & = & 9 & 10 & 0 \\
47 \text{ hf. cr.} & = & 5 & 17 & 6 \\
29 \text{ fl.} & = & 2 & 18 & 0 \\
117 \text{ sh.} & = & 5 & 17 & 0 \\
93 \text{ sixp.} & = & 2 & 6 & 6 \\
59 \text{ fourp.} & = & 0 & 19 & 8 \\
37 \text{ threep.} & = & 0 & 9 & 3 \\
15 \text{ pence} & = & 0 & 1 & 3 \\
18 \text{ halfp.} & = & 0 & 0 & 9 \\
\hline
& & \pounds 34 & 19 & 11 \\
\end{array}
$$

EXERCISE V.

(1)...
$$
\begin{array}{r}
19015034 \\
3070055 \\
\hline
15944979
\end{array}
$$

(2)...
$$
\begin{array}{lr}
& d. \\
17 \text{ hf. gui.} = & 2142 \\
29 \text{ hf. cr.} = & 870 \\
13 \text{ fl.} = & 312 \\
23 \text{ sh.} = & 276 \\
\end{array}
$$

$4)\overline{3600}$

900 fourp.

(3)... £11 17s. 6d. = 2850 pence

2850÷50 = 57 dollars

$$
\begin{array}{l}
\quad\quad \text{t.} \quad \text{cwt.} \quad \text{qrs.} \quad \text{lb.} \quad \text{oz.}\\
(4)\ldots\quad 19 \quad 17 \quad 3 \quad 19 \quad 11\\
\quad\quad\quad 20\\
\quad\quad \overline{397}\\
\quad\quad\quad 4\\
\quad\quad \overline{1591}\\
\quad\quad\quad 28\\
\quad\quad \overline{12747}\\
\quad\quad 3182\\
\quad\quad \overline{44567}\\
\quad\quad\quad 16\\
\quad\quad \overline{267413}\\
\quad\quad 44567\\
\quad\quad \overline{713083} \text{ ounces}
\end{array}
\qquad
\begin{array}{l}
\quad\quad \text{mi.} \quad \text{fur.} \quad \text{po.}\\
(5)\ldots\quad 37 \quad 5 \quad 19\\
\quad\quad\quad 8\\
\quad\quad \overline{301}\\
\quad\quad\quad 40\\
\quad\quad \overline{12059}\\
\quad\quad\quad 5\tfrac{1}{2}\\
\quad\quad \overline{60295}\\
\quad\quad 6029\tfrac{1}{2}\\
\quad\quad \overline{66324\tfrac{1}{2}}\\
\quad\quad\quad 3\\
\quad\quad \overline{198973\tfrac{1}{2}}\\
\quad\quad\quad 12\\
\quad\quad \overline{2387682} \text{ inches}
\end{array}
$$

$$
\begin{array}{l}
\quad\quad \text{sec.}\\
(6)\ldots 60)85693495\\
\quad\ \ 60)\overline{1428224}\ \ 55 \text{ sec.}\\
\quad\quad\ \ 24)\ \overline{23803}\ \ 44 \text{ min.}\\
\quad\quad\quad\quad\quad \overline{991}\ \ 19 \text{ hours}
\end{array}
$$

Ans. 991 dys. 19 h. 44 m. 55 sec.

$$
\begin{array}{l}
\quad\quad \pounds \quad s. \quad d.\\
(7)\ldots 97)359 \ 16 \ \ 2\tfrac{1}{4}(\pounds3\ 14s.\ 2\tfrac{1}{4}d.\\
\quad\quad 291\\
\quad\quad \overline{68}\\
\quad\quad 20\\
\quad 97)\overline{1376}(14s.\\
\quad\quad 97\\
\quad\quad \overline{406}\\
\quad\quad 388\\
\quad\quad \overline{18}\\
\quad\quad 12\\
\quad 97)\overline{218}(2d.\\
\quad\quad 194\\
\quad\quad \overline{24}\\
\quad\quad 4\\
\quad 97)\overline{97}(1 \text{ far.}\\
\quad\quad 97
\end{array}
$$

$$
\begin{array}{l}
\quad\quad s.\ \ d.\ \ s.\ \ s.\ \ d.\ \ s.\ \ d.\\
(8)\ldots 2\ \ 6+2+1+4 = 5\ \ 10\\
\quad\quad\quad\quad\quad\quad\quad\quad = 70 \text{ pence}\\
\quad\quad 5 \text{ gui.} = 1260 \text{ pence}\\
\quad 1260 \div 70 = 18 \text{ of each coin}
\end{array}
$$

$$
\begin{array}{l}
(9)\ldots \quad \pounds567\ 15s. = \pounds567\tfrac{3}{4}\\
\quad\quad\quad\quad\quad\quad 7\\
\quad\quad 12)\overline{3974\tfrac{1}{4}}\\
\quad\quad\quad 20)\overline{331}\ \ 2\tfrac{1}{4}\\
\quad\quad\quad\quad \overline{\pounds16}\ \ 11\ \ 2\tfrac{1}{4}
\end{array}
$$

$$
\begin{array}{l}
\quad\quad\quad\quad\quad \text{da.}\\
(10)\ldots \quad 135\\
\quad\quad\quad\quad 10\tfrac{1}{2}\\
\quad\quad\quad \overline{1350}\\
\quad\quad\quad\ 67\tfrac{1}{2}\\
\quad\quad 12)\overline{1417\tfrac{1}{2}}\\
\quad\quad 20)\overline{118}\ \ 1\tfrac{1}{2}\\
\quad\quad\quad \overline{\pounds5}\ \ 18\ \ 1\tfrac{1}{2}
\end{array}
$$

EXERCISE VI.

(1)...
$$
\begin{array}{r}
279 \\
553 \\
\hline
837 \\
1395 \\
1395 \\
\hline
\end{array}
$$

79)154287(1953
$$
\begin{array}{r}
79 \\
\hline
752 \\
711 \\
\hline
418 \\
395 \\
\hline
237 \\
237 \\
\hline
\end{array}
$$

(2)...
$$
\begin{array}{r}
\text{hf. cr.} \\
86 \\
30 \\
\hline
4)2580 \\
\hline
645 \text{ fourpenny-pieces}
\end{array}
$$

(3)...
$$
\begin{array}{r}
\text{far.} \\
4)298765 \\
\hline
12)74691\tfrac{1}{4} \\
\hline
20)6224 \quad 3\tfrac{1}{4} \\
\hline
\pounds311 \quad 4s. \quad 3\tfrac{1}{4}d.
\end{array}
$$

(4)...
lb.	oz.	dwt.	grs.
23	9	17	21

$$
\begin{array}{r}
12 \\
\hline
285 \\
20 \\
\hline
5717 \\
24 \\
\hline
22889 \\
11434 \\
\hline
137229 \text{ grains}
\end{array}
$$

(5)...
$$
\begin{array}{r}
\text{inches} \\
12)8432765297 \\
\hline
3)702730441 \quad 5 \text{ in.} \\
\hline
1760)234243480 \quad 1 \text{ ft.}(133092 \text{ mi.} \\
1760 \\
\hline
5824 \\
5280 \\
\hline
5443 \\
5280 \\
\hline
16348 \\
15840 \\
\hline
5080 \\
3520 \\
\hline
1560 \text{ yards}
\end{array}
$$

Ans. 133092 mi. 1560 yds. 1 ft. 5 in.

(6)..
ac.	ro.	po.
7	2	19

$$
\begin{array}{r}
4 \\
\hline
30 \\
40 \\
\hline
1219 \\
30\tfrac{1}{4} \\
\hline
36570 \\
304\tfrac{3}{4} \\
\hline
36874\tfrac{3}{4} \text{ sq. yards}
\end{array}
$$

(7)...
$$
\begin{array}{r}
\pounds \quad s. \quad d. \\
89 \quad 12 \quad 7\tfrac{1}{2} \\
57\tfrac{1}{2} \text{ gui.} = 60 \quad 7 \quad 6 \\
\hline
\pounds29 \quad 5 \quad 1\tfrac{1}{2}
\end{array}
$$

(8)...
3 tons 9 cwt. 5 lb. = 7733 lb.
1 cwt. 3 qrs. 13 lb. = 209 lb.

$$7733 \div 209 = 37$$

(9)...   10 oz. 12 dwt. 15 grs. = 5103 grs.
                6 lb. 5 oz. 19 dwt. 6 grs. = 37422 grs.
                        $37422 \div 5103 = 7\frac{1}{8}$ dozen
                                = 88 spoons

                                              s.   *d.*
(10)...   3 doz. Port   at 45*s*. 6*d*. per doz. = 136   6
       4 doz. Sherry at 37*s*. 9*d*.   „   = 151   0
                                              287   6

                    s. d.   d. 12
                    3 10 $=$ 46)3450(75 lb.
                               322
                               230
                               230

EXERCISE VII.

                  £   *s. d.*   mi. fur. yds. ft.
(1)...23 gui.   = 24   3   0   (2)...35½ miles = 35 4   0 0
     37 sov.   = 37   0   0   19 7 175 2
     55 cr.   = 13 15   0   15 4   44 1
     31 fl.   = 3   2   0
     53 sixp. = 1   6   6   cwt. qrs. lb. oz.
     79 pence = 0   6   7   (3)... 17 3 19   9
                £79 13   1 $3 \times 6 = 18$
                                        2 13 3   2 11
                                                       6
                                  tons 16 2 2 16   2

(4)...   ac. ro. per.   E. ells qrs. na.
                    $45 \begin{cases} 5)39 & 3 & 30 \\ 9)7 & 3 & 38 \end{cases}$ (5)... 19   3   2
                                                             5
                              3   22   98
                                                            4
                                                           394
         s. d.   2¼
(6)... 1   6   788
             $3 \times 6 + 1\frac{1}{2} = 19\frac{1}{2}$ 98½
        4   6   886½ inches
            6
        1   7   0
            1   6
                9
       £1   9   3

(7)...
```
   yds.      yds.
   2⅜        33¼
    8         8
   19     19)266(14 pairs
             19
             76
             76
```

(8)...
```
           £   s.   d.
      ┌ 7)3  10  10½
  63 ┤  9)   10   1½
      └      1    1½ per lb.
```

(9)...
```
            gal.
             57
              8
            456
  pt.  hf. pts.  2
  1½ = 3)912 half pints
        304 bottles
```

(10)...
```
      £   s.  d.
   9)72  18  0
  12)8    2  0
   6)    13  6 per week each
         2   3 per day each
```

EXERCISE VIII.

(1)...
```
   13009046
     560019
   12449027
```

(2)...
```
                halfpence
          d. 2)9324
  hf. gui. = 126)4662(37 half-guineas
               378
               882
               882
```

(3)...
```
    t.  cwt.  qr.  lb.
    17   13    1   19
         20
        353
          4
       1413
         28
      11323
       2826
      39583
         16
     237498
      39583
     633328 ounces
```

(4)...
```
     ac.  ro.  per.
     13    0    27
            4
           52
           40
         2107
          30¼
        63210
         526¾
       63736¾ sq. yards
```

	cu. yds.	cu. ft.
(5)...	19	22
	27	

	155
	38
	535
	1728
	4280
	1070
	3745
	535
	924480 cubic inches

	qrs.	bu.	pks.
(6)...	27	5	3
	8		

	221
	4
	887
	2
	1774 gallons

			£	s.	d.
(7)...	57 gui.	=	59	17	0
	39 sov.	=	39	0	0
	49 hf. cr.	=	6	2	6
	27 fl.	=	2	14	0
	73 sh.	=	3	13	0
		£1	11	6	6

	s.	d.
(8)...	3	8

$$7 \times 11 + 2 = 79$$

		s.	d.
	1	5	8
			11
	14	2	4
		7	4
8 oz. =		1	10
2 oz. =			5½
£14	11	11½

	s.	d.
(9)...1	4	= one-fifteenth of £1

	£	s.	d.
15 { 3)57	15	0	= 55 guineas
5)19	5	0	
£3	17	0	

	qrs.	bu.
(10)...	10	4
	8	

	84
	4
	336
	4
	3)1344 quarter pecks
	7)448
	64 days

EXERCISE IX.

(1)...
	£	s.	d.
19 sov. =	19	0	0
37 hf. cr. =	4	12	6
	23	12	6

$$20$$
$$\overline{472}$$
$$12$$
$$\overline{5670}$$
$$4$$
$$\overline{22680}\ \text{far.}$$

(2)...100 gui. = 25200 pence

£1 6 3 = 315 pence

25200 ÷ 315 = 80 portions

(3)...84 $\left\{ \begin{array}{l} 7)69\ \ 6\ \ 0 \\ 12)9\ \ 18\ \ 0 \end{array} \right.$

	£	s.	d.

     16 6 per gal.

(4)...
	s.	d.
	4	6
	3 × 9 = 27	
	13	6
		9
	6	1 6

$\frac{3}{4}$ yd. = 3 4$\frac{1}{2}$

£6 4 10$\frac{1}{2}$

(5)...
oz.
$$16)27563$$
$$28)\overline{1722}\quad 11\ \text{oz.}$$
$$4)\overline{61}\quad 14\ \text{lb.}$$
$$\overline{15}\quad 1\ \text{qr.}$$

Ans. 15 cwt. 1 qr. 14 lb. 11 oz.

(6)... 2 oz. 3 dwt. 6 grs. = 1038 grains

19 oz. 9 dwt. 6 grs. × 6 = 116 oz. 15 dwt. 12 grs.

= 56052 grains

56052 ÷ 1038 = 54 spoons

(7)...
in.
$$643\tfrac{1}{2}$$
in.
$$2\tfrac{1}{4} \times 4 = 9)\overline{2574}$$
$$4)\overline{286}$$
$$4)\overline{71}\quad 2\ \text{na.}$$
$$\overline{17}\quad 3\ \text{qrs.}$$

Ans. 17 yds. 3 qrs. 2 na.

(8)...
yds.
$$17$$
$$13$$
$$\overline{51}$$
$$17$$
$$\overline{221}$$
$$9$$
$$\overline{1989}\ \text{sq. feet}$$

(9)...
	£	s.	d.
9)	10	2	6
12)	1	2	6 per doz.
	1	10$\frac{1}{2}$ per pair

(10)...
	s.	d.	s.
10 gl. at	15	6 =	155
12 „	16	3 =	195
14 „	17	0 =	238
36			

36 $\left\{ \begin{array}{l} 6)\overline{588} \\ 6)\overline{98} \end{array} \right.$

16s. 4d. per gal.

EXERCISE X.

(1) (2)...See "*Answers.*"

(3)...
$$\begin{array}{r} \text{hf. cr.} \\ 294 \\ 5 \end{array}$$

hf. gui. = 21 $\begin{cases} \text{sixp.} \left\{ 3\overline{)1470} \right. \\ 7\overline{)490} \end{cases}$

70 hf. gui.

(4)...
$$\begin{array}{r} \text{far.} \\ 4\overline{)7296859} \\ 12\overline{)1824214\tfrac{3}{4}} \\ 20\overline{)152017\ 10\tfrac{3}{4}} \\ \pounds7600\ 17s.\ 10\tfrac{3}{4}d. \end{array}$$

(5)...
$$\begin{array}{cccc} \text{mi.} & \text{fur.} & \text{per.} & \text{yds.} \\ 15 & 3 & 29 & 4\tfrac{1}{2} \\ 8 \end{array}$$
. 123
40
4949
$5\tfrac{1}{2}$
$24749\tfrac{1}{2}$
$2474\tfrac{1}{2}$
27224
3
81672
12
980064 inches

(6)...
$$\begin{array}{ccc} \text{wks.} & \text{da.} & \text{hrs.} \\ 17 & 5 & 19 \\ 7 \end{array}$$
124
24
515
248
2995
60
179700 minutes

(7)...
$$\begin{array}{ccc} \pounds. & s. & d. \\ 19 & 13 & 5\tfrac{3}{4} \end{array}$$
$3 \times 7 \times 11 = 231$
59   0 $5\tfrac{1}{4}$
7
413   3 $0\tfrac{3}{4}$
11
$\pounds4544$ 13 $8\tfrac{1}{4}$

(8)...
$$\begin{array}{cc} \text{mi.} & \text{fur.} \\ 17 & 5 \\ 8 \end{array}$$
141
220
2820
282
31020
3
$16920\overline{)93060}(5$ ft. 6 in.
84600
8460
12
$16920\overline{)101520}(6$ in.
101520

(9)...34¾ yds. × 7 = 243¼ yds.

$$
\begin{array}{rcc}
 & s. & d. \\
 & 11 & 9 \\
\hline
 & 3 \times 9 \times 9 & = 243 \\
\hline
1 \quad 15 & 3 \\
 & 9 \\
\hline
15 \quad 17 & 3 \\
 & 9 \\
\hline
142 \quad 15 & 3 \\
\end{array}
$$

¼ yd.=   2   11¼
£142 18   2¼

(10)...1 mile = 5280 feet
11
58080
in.   12
2 ft. 6 in. = 30)696960
23232 steps

EXERCISE XI.

pence
(1)...163 gui. =163 × 21 × 12 = 41076
217 sov. =217 × 20 × 12 = 52080
73 hf. cr.= 73 × 30   = 2190
125 sh.   =125 × 12   = 1500
96846
4
387384 far.

(2)...774
178
2)596
298 less no.
178
476 greater no.

476 × 298 = 141848

inches
(3)... 12)1488960
3)124080
1760)41360(23½ miles
3520
6160
5280
880
1760 = ½

sq. yds. sq. ft.
(4)... 33   7
9
304
144
1216
1216
304
43776 sq. inches

qrs. bu. pks.
(5)...   29 5 3
8
237
4
951
2
1902 gallons

£   s.   d.
(6)... 19 13 9¾
7 × 7 = 49
137 16 8¼
7
£964 16 9¾

	£	s.	d.

$$(7)\ldots 63 \begin{cases} 7)\overline{483\quad 3\quad 11\frac{1}{4}} \\ 9)\overline{69\quad 0\quad 6\frac{3}{4}} \end{cases}$$

$$\overline{£7\quad 13\quad 4\frac{3}{4}}$$

	wks.	da.	hrs.	min.
(8)...	84	3	16	35 = 852035 min.
	3	4	17	25 = 37045 min.

$$852035 \div 37045 = 23$$

$$(10)\ldots\quad \begin{array}{cc} s. & d. \\ 15 & 9 \\ \hline & 12 \\ \hline 189 & 0 \\ \hline & 12 \\ \hline 2268 \\ \hline \quad 2 \end{array}$$

$$(9)\ldots \quad \begin{array}{ccccc} lb. & lb. & lb. & lb. & qr.\ lb. \end{array}$$
$$1 + \tfrac{1}{2} + \tfrac{1}{4} = 1\tfrac{3}{4} = 7$$

$$\begin{array}{c} lb. \\ 89\frac{1}{4} \\ 4 \\ \hline 7)357 \\ \hline 51\ \text{of each} \end{array}$$

$$\begin{array}{cc} d. & hf.\,d. \\ 13\frac{1}{2} = & 27)\overline{4536}(168\ \text{yards} \\ & 27 \\ & \overline{183} \\ & 162 \\ & \overline{216} \\ & 216 \\ & \overline{} \end{array}$$

EXERCISE XII.

		£	s.	d.
(1)...	1000 sov. =	1000	0	0
	1000 sh. =	50	0	0
	1000 pence =	4	3	4
	1000 far. =	1	0	10
		£1055	4	2

	£	s.	d.
(2)...	629	17	4
		20	

$$\overline{12597}$$
$$3$$
$$\overline{37792}\ \text{fourpenny-pieces}$$

(3)... £2 13 2¼ = 2553 far.
£124 19 9¾ = 119991 far.

119991 ÷ 2553 = 47 times

$$\begin{array}{cc} oz. & dwt. \\ (4)\ldots\quad 27 & 9 \\ & 7 \\ \hline 192 & 3 \\ 20 \\ \hline 3843 \\ 24 \\ \hline 15372 \\ 7686 \\ \hline 92232\ \text{grains} \end{array}$$

$$(5)\ldots\quad \begin{array}{c} lb. \\ 28)356724 \\ \hline 4)12740\quad 4\ lb. \\ \hline 20)3185 \\ \hline 159\quad 5\ cwt. \end{array}$$

Ans. 159 tons 5 cwt. 4 lb.

$$\begin{array}{cc} hands & in. \\ (6)\ldots\quad 16 & 1 \\ & 4 \\ \hline 12)65 \\ \hline 5ft.\quad 5\ in. \end{array}$$

(7)...
$$22 \begin{cases} 2)\overline{1760} = 1 \text{ mile} \\ 11)\overline{880} \end{cases}$$
$$\overline{80} \text{ chains}$$

(8)...
$$\begin{array}{cccc} \text{ft.} & \text{ft.} & \text{ft.} & \text{cu. ft.} \\ 7 \times 5 \times 3 & = & 105 \end{array}$$

1 cubic foot = 1728 cu. in.

$$\begin{array}{r} 105 \\ \hline 8640 \\ 1728 \\ \hline 181440 \text{ cu. in.} \end{array}$$

(9)...
$$\begin{array}{cccc} \text{da.} & \text{hrs.} & \text{min.} & \text{sec.} \\ 9 & 17 & 35 & 25 \\ & & 4 \times 7 & = 28 \\ \hline 38 & 22 & 21 & 40 \\ & & & 7 \\ \hline 272 & 12 & 31 & 40 \end{array}$$

(10)...
$$168 \begin{cases} 4)\overline{373 \quad 16 \quad 0} \\ 6)\overline{93 \quad 9 \quad 0} \\ 7)\overline{15 \quad 11 \quad 6} \end{cases}$$
$$\begin{array}{ccc} \pounds. & s. & d. \end{array}$$
$$\overline{\pounds2 \quad 4 \quad 6} \text{ per acre}$$

EXERCISE XIII.

(1)...
$$\begin{array}{ccccc} \text{t.} & \text{cwt.} & \text{qrs.} & \text{lb.} & \text{oz.} \\ 35 & 5 & 1 & 10 & 6 \\ 23 & 13 & 0 & 23 & 14 \\ \hline 11 & 12 & 0 & 14 & 8 \end{array}$$

(2)...
$$\begin{array}{l} 379 \text{ quotient} \\ 257 \text{ divisor} \\ \hline 2653 \\ 1895 \\ 758 \\ \quad 73 \text{ remainder} \\ \hline 97476 \text{ dividend} \end{array}$$

(3) ..
$$\begin{array}{lll} & & \text{far.} \\ 1 \text{ sov.} & = & 960 \\ 1 \text{ hf. sov.} & = & 480 \\ 1 \text{ cr.} & = & 240 \\ 1 \text{ hf. cr.} & = & 120 \\ \hline & & 1800 \\ & & 17 \\ \hline & & 12600 \\ & & 1800 \\ \hline & & 30600 \text{ farthings} \end{array}$$

(4)...
$$\begin{array}{ccc} \text{mi.} & \text{fur.} & \text{yds.} \\ 17 & 5 & 137 \\ & & 8 \\ \hline & & 141 \\ & & 220 \\ \hline & & 2957 \\ & & 282 \\ \hline & & 31157 \\ & & 3 \\ \hline & & 93471 \\ & & 12 \\ \hline & & 1121652 \text{ inches} \end{array}$$

(5)...
$$\begin{array}{cc} \text{gal.} & \text{qts.} \\ 17 & 3 \\ 4 & \\ \hline 71 & \\ 2 & \\ \hline 142 \text{ pints} \end{array}$$

(6)...1 mile = 1760 yards
133
———
5280
5280
1760
49280)234080(4¾ yards
197120
———
36960
——— = ¾
49280

(7)...£3 17 6¼ = 3721 far.
£360 9 5¼ = 346053 far.

346053÷3721 = 93 times

(8)...£536 15s. = £536¾
7
12)3757¼
20)313 1¼
£15 13 1¼

(9)...150 gui. =

£	s.	d.
157	10	0
16	1	3
141	8	9

20
365)2828(7s. 9d.
2555
———
273
12
365)3285(9d.
3285

(10...

yds.
47¼
12
———
567

yds. hf.-yds. 2
3½ = 7)1134
———
162 shirts

EXERCISE XIV.

(1)...

bf. gui.
175
21
———
175
350
5)3675
———
735 half-crowns

(2)...

lb.	oz.	drs.	scr.	grs.
29	9	5	2	17

12
———
357
8
———
2861
3
———
8585
20
———
171717 grains

c

(3)...
```
          ounces
    16)3467163
    28)216697    11 oz.
     4) 7739     5 lb.
    20)1934      3 qrs.
         96     14 cwt.
```

(4)...
$$
\begin{array}{cc}
s. & d. \\
1 & 8 \\
\multicolumn{2}{r}{5 \times 7 = 35} \\
\hline
8 & 4 \\
 & 7 \\
\hline
2 \quad 18 & 4 \\
\end{array}
$$

Ans. 96 tons 14 cwt. 3 qrs. 5 lb. 11 oz.

(5)...
$$
18 \left\{ \begin{array}{l} \begin{array}{ccc} & s. & d. \\ 3)10 & 1\frac{1}{2} \\ \hline 6)3 & 4\frac{1}{2} \\ \hline \end{array} \\ \qquad 6\frac{3}{4}d. \text{ per lb.} \end{array} \right.
$$

$$
\begin{array}{cc}
s. & d. \\
3 & 6 \\
\multicolumn{2}{r}{5 \times 9 = 45} \\
\hline
17 & 6 \\
 & 9 \\
\hline
7 \quad 17 & 6 \\
2 \quad 18 & 4 \\
\hline
\pounds 10 \quad 15 & 10 \\
\end{array}
$$

(6)...2 lb. 12 oz. = 44 oz.
   16 cwt. 2 qrs. = 29568 oz.

   29568÷44 = 672 parcels

(7)...
$$
\begin{array}{cc}
s. & d. \\
4 & 6 \\
\multicolumn{2}{r}{5 \times 10 = 50} \\
\hline
1 \quad 2 & 6 \\
 & 10 \\
\end{array}
$$

$$
30 \left\{ \begin{array}{l} 5)\overline{11 \quad 5 \quad 0} \\ 6)\overline{2 \quad 5 \quad 0} \\ \hline \quad 7 \quad 6 \text{ per yard} \end{array} \right.
$$

(8)...
```
        cwt. qrs. lb.
         3    2   20
         4
        ‾‾‾‾
         14
         28
        132
         28
        ‾‾‾‾
        412 lb.
         4¼
        ‾‾‾‾
       1648
        103
     12)1751
     20)145   11
        ‾‾‾‾‾
        £7   5s.  11d.
```

(9)... 1 mile = 5280 feet
$$
1 \text{ hour } = 3600)\overline{158400}(44 \text{ feet}
$$
```
           sec.        30
                     14400
                    ‾‾‾‾‾‾
                     14400
                     14400
                    ‾‾‾‾‾‾
```

(10)...3795
       709
     2)3086
     ‾‾‾‾‾‾
      1543 No. for unsuccessful c.
       709
      ‾‾‾‾‾
      2252 No. for successful c.

EXERCISE XV.

(1)...
$$
\begin{array}{r}
\text{far.}\\
4)\overline{7268439}\\
12)\overline{1817109\tfrac{3}{4}}\\
20)\overline{151425}\quad 9\tfrac{3}{4}\\
\hline
\text{\pounds}7571\quad 5s.\quad 9\tfrac{3}{4}d.
\end{array}
$$

(2)...
$$
\begin{array}{r}
\text{ac.}\ \ \text{ro.}\ \ \text{po.}\\
23\ \ \ 2\ \ \ 31\\
4\\
\hline
94\\
40\\
\hline
3791\\
30\tfrac{1}{4}\\
\hline
113730\\
947\tfrac{3}{4}\\
\hline
114677\tfrac{3}{4}\ \text{sq. yards}
\end{array}
$$

(3)...

		£	s.	d.
Bank-note	=	5	0	0
7 sov.	=	7	0	0
6 hf. sov.	=	3	0	0
59 hf. cr.	=	7	7	6
27 fl.	=	2	14	0
93 sh.	=	4	13	0
71 sixpences	=	1	15	6
46 fourp.	=	0	15	4
51 threep.	=	0	12	9
17 pennies	=	0	1	5
5 halfp.	=	0	0	2½
		£32	19	8½

(4)...
$$
\begin{array}{l}
\text{gui.}\\
55\\
1\ \text{gui.} = 42\ \text{sixpences}\\
\overline{110}
\end{array}
$$

$$
\begin{array}{l}
s.\ \ d.\quad \text{sixp.}\quad 220\\
27\ \ 6 = 55)\overline{2310}(42\ \text{weeks}\\
\qquad\qquad\quad 220\\
\qquad\qquad\ \overline{\quad 110}\\
\qquad\qquad\quad 110
\end{array}
$$

(5)...

7 ac. 4295 sq. yds. = 38175 sq. yds.

16 per. 25 sq. yds. = 509 sq. yds.

38175 ÷ 509 = 75 allotments

(6)...
$$
\begin{array}{rr}
s. & d.\\
13 & 6\\
11 & 9\\
\hline
1 & 9\ \text{profit on 1 yd.}\\
& 5\times5\times7 = 175\\
\hline
8 & 9\\
& 5\\
\hline
2\ \ 3 & 9\\
& 7\\
\hline
\text{\pounds}15\ \ 6 & 3
\end{array}
$$

(7)... 65½ doz. = 786 bottles

$$
\begin{array}{l}
\text{\pounds}\quad s.\\
91\quad 14\\
20\\
\hline
786)\overline{1834}(2s.\ 4d.\ \text{per bottle}\\
\quad\ 1572\\
\quad\ \overline{\ 262}\\
\qquad 12\\
786)\overline{3144}(4d.\\
\quad\ 3144
\end{array}
$$

$$\overset{\text{yds.}}{(8)\ldots 181\tfrac{1}{2}} \times \overset{\text{yds.}}{140} = 25410 \text{ sq. yds.}$$
$$= 5\tfrac{1}{4} \text{ acres}$$

$(9)\ldots 4$ cwt. 3 qrs. $= 532$ lb.

	£	s.	d.
50 guineas =	52	10	0

$$5\tfrac{1}{4}$$

	£	s.	d.
	262	10	0
	13	2	6
	£275	12	6

$$532$$
$$5$$
$$12)\overline{2660}$$
$$20)\overline{221\ \ 8}$$

	11	1	8 selling price
$9\tfrac{1}{2}$ gui. =	9	19	6 cost price
	£1	2	2 profit

$(10)\ldots$ 5 times in 6 sec. $= \overset{\text{times}}{50}$ per minute
$$60$$
$$\overline{3000} \text{ per hour}$$
$$24$$
$$\overline{72000} \text{ per day}$$
$$7$$
$$\overline{504000} \text{ per week}$$

EXERCISE XVI.

$(1)\ldots$
$$\overset{\text{far.}}{4)14280}$$
$$30)\overline{3570}$$
$$\overline{119} \text{ half-crowns}$$

$(2)\ldots 81 \begin{cases} \overset{£\quad s.\quad d.}{9)18\ \ 11\ \ 3} \\ 9)\overline{2\ \ 1\ \ 3} \end{cases}$
$$\overline{4\ \ 7} \text{ per pair}$$

$(3)\ldots$

mi.	fur.	yds.
43	3	56
19	7	175
23	3	101

$(4)\ldots 36 \begin{cases} \overset{\text{lb.}\quad\text{oz.}\quad\text{dwt.}\quad\text{grs.}}{6)203\ \ 9\ \ 1\ \ 12} \\ 6)\overline{33\ \ 11\ \ 10\ \ 6} \end{cases}$
$$\overline{5\ \ 7\ \ 18\ \ 9}$$

$(5)\ldots$

ac.	ro.	po.
9	3	27
13	0	35
11	2	19
7	1	15
19	0	25
8	3	15
12	2	0
82	2	16

$(6)\ldots$

	s.	d.	£	s.	d.
$1\tfrac{1}{2}$ doz. at	47	6 =	3	11	3
$2\tfrac{1}{2}$ doz. at	38	6 =	4	16	3
			£8	7	6

(7)...　1 acre = 4840 sq. yards

$$5\tfrac{1}{4}$$

24200

1210

$35\begin{cases} 5)\overline{25410} \\ 7)\overline{5082} \end{cases}$

726 trees

	s.	d.
(8)... 1	9	per day
	6	
10	6	per week
	7	
3 13	6	
	9	
£33 1	6	

(9)...

	£	s.	d.
	24	14	4½
	20		

494

12

$7)\overline{5932\tfrac{1}{2}}$

$847\tfrac{1}{2}$ = £847 10s.

(10)...　2¼ tons = 45 cwt.

$45\begin{cases} 5)1 \quad 8 \quad 1\tfrac{1}{2} \\ 9)\quad\; 5 \quad 7\tfrac{1}{2} \end{cases}$

$7\tfrac{1}{2}d.$ per cwt.

EXERCISE XVII.

(1)...

	£	s.	d.
19 gui. =	19	19	0
13 sov. =	13	0	0
25 hf.-cr. =	3	2	6
	36	1	6

20

721

12

8658

4

34632 far.

	£	s.	d.
$\begin{cases} 7)3378 \\ 7)482 \\ 9)68 \end{cases}$	3378 14	0¾
	482 13	5¼
	68 19	0¾
441	£7 13	2¾

(2)...

£	s.	d.	£	s.	d.
441)3378	14	0¼(7	13	2¾

3087

291

20

441)5834(13s.

441

1424

1323

101

12

441)1212(2d.

882

330

4

441)1323(3 far.

1323

(3)...
$$\begin{array}{ccc} \text{ac.} & \text{ro.} & \text{po.} \\ 13 & 3 & 15 \\ & & 4 \\ \hline & & 55 \\ & & 40 \\ \hline & & 2215 \\ & & 30\tfrac{1}{4} \\ \hline & & 66450 \\ & & 553\tfrac{3}{4} \\ \hline & & 67003\tfrac{3}{4} \text{ sq. yards} \end{array}$$

(4)...
$$\begin{array}{ccc} \text{cwt.} & \text{qrs.} & \text{lb.} \\ 2 & 3 & 21 \\ & & 4 \\ \hline & & 11 \\ & & 28 \\ \hline & & 329 \text{ lb.} \\ & & 15\tfrac{1}{2} \\ \hline & & 1645 \\ & & 329 \\ & & 164\tfrac{1}{2} \\ \hline 12) & & 5099\tfrac{1}{2} \\ 20)424 & & 11\tfrac{1}{2} \\ \hline £21 & 4 & 11\tfrac{1}{2} \end{array}$$

(5)...
$$\begin{array}{ccc} £ & s. & d. \\ 1 & 12 & 6 \end{array}$$
$$5 \times 5 = 25$$
$$\begin{array}{ccc} 8 & 2 & 6 \\ & & 5 \end{array}$$
$$30 \left\{ \begin{array}{ccc} 5)40 & 12 & 6 \\ 6)8 & 2 & 6 \end{array} \right.$$
$$£1 \quad 7 \quad 1 \text{ per gallon}$$

(6)...
$$\begin{array}{ccc} £ & s. & d. \\ 2 & 3 & 6 \end{array}$$
$$6 \times 6 \times 10 + 5 = 365$$
$$\begin{array}{ccc} 13 & 1 & 0 \\ & & 6 \\ \hline 78 & 6 & 0 \\ & & 10 \\ \hline 783 & 0 & 0 \\ 10 & 17 & 6 \\ \hline 793 & 17 & 6 \text{ yearly expenditure} \\ 350 & 0 & 0 \\ \hline £1143 & 17 & 6 \text{ yearly income} \end{array}$$

(7)...
25 perches $= 756\tfrac{1}{4}$ sq. yds.
$= 6806\tfrac{1}{4}$ sq. ft.
$= 980100$ sq. in.

$980100 \div 180 = 5445$ cabbages

(8)...
$$\begin{array}{cccccc} & & s. & d. & £ & s. & d. \\ 18\tfrac{3}{4} \text{ yds. silk velvet} & 7 & 6 & = 7 & 0 & 7\tfrac{1}{2} \\ 3\tfrac{1}{2} \text{ „ cloth} & 12 & 9 & = 2 & 4 & 7\tfrac{1}{2} \\ \hline & & & £9 & 5 & 3 \end{array}$$

(9)...
$$\begin{array}{ccc} \text{ac.} & \text{ro.} & \text{po.} \end{array}$$
$$17)60 \quad 3 \quad 4(3 \text{ ac. 2 ro. 12 po.}$$
$$\begin{array}{c} 51 \\ \hline 9 \\ 4 \\ \hline 17)39(2 \text{ ro.} \\ 34 \\ \hline 5 \\ 40 \\ \hline 17)204(12 \text{ po.} \\ 204 \\ \hline \end{array}$$

(10)...
$$\begin{array}{c} \text{gal.} \\ 250 \text{ per hour} \\ 24 \\ \hline 1000 \\ 500 \\ \hline 360)6000(16\tfrac{2}{3} \text{ gal.} \\ 360 \\ \hline 2400 \\ 2160 \\ \hline 240 \\ \hline 360 \end{array} = \tfrac{2}{3}$$

EXERCISE XVIII.

(1)...
£
735
20
21)14700
700 guineas

(2)...
grains
20)5968341
3)298417 1 gr.
8)99472 1 scr.
12)12434
1036 2 oz.

Ans. 1036 lb. 2 oz. 0 dr. 1 scr. 1 gr.

(3)...
t.	cwt.	qrs.	lb.	oz.
17	13	2	23	13
25	11	1	19	7
13	17	2	11	9
57	2	2	26	13

(4)... 2 qrs. 11½ lb.=135 hf. lb.
1 ton 7 cwt. 2 qrs 25 lb.=6210 hf. lb.

6210÷135=46 parcels

(5)...
yards   fur.
220)49025(8)222
440   27 mi. 6 fur.
502
440
625
440
185 yards

Ans. 27 mi. 6 fur. 185 yds.

(6)...¾ mile = 1320 yards

2¾ yds. =
qrs.   4
11)5280
480 times

(7)
cu. yds. cu. ft.
...43   19
27
320
86
1180
1728
9440
2360
8260
1180
2039040 cu. inches

(8)...56 {
£   s.   d.
7)10 14 8
8)1 10 8
3 10 per lb.
}

(9)... 3 yds. 3 qrs. 2 na.=62 nails
34 yds. 3 qrs. 2 na.=1674 nails

1674÷62=27 suits

(10)...   25+17 = 42 sheep

£   s.   d.
42 sheep at 1½ gui. each = 66 3 0
£36+£25 = 61 0 0
profit = £5 3 0

EXERCISE XIX.

	qrs.	lb.	oz.
(1)...	3	17	8

$$3 \times 9 = 27$$

	2	2	24	8
				9
	1	4	1 · 24	8

Ans. 1 ton 4 cwt. 1 qr. 24 lb. 8 oz.

	£	s.	d.
(2)...	153	19	2
	20		

3079

$$d.\underline{12}$$

4s. 2d. = 50)36950

739 dollars

(3)...

$$42 \begin{cases} 6)1 & 9 & 9 \\ 7) & 4 & 11\frac{1}{2} \end{cases}$$
£ s. d.

$8\frac{1}{2}d.$ per lb.

(4)...

yds.
363
126
2178
726
363
45738 sq. yards
4

(5)...Leap year contains 366 da.

24

1464
732
8784 hrs.

yds.   qrs.
$30\frac{1}{4}=121$ $\begin{cases} 11)182952 \\ 11)16632 \end{cases}$
40)1512
4)37 32 per.
9 ac. 1ro. 32 per.

(6)...$\frac{3}{4}$ acre = 3630 sq. yds.
3s. 9d. =   45 pence
18150
14520
12)163350
20)13612   6
£680 12s. 6d.

	s.	d.
(7)...	14	6
		$13\frac{3}{4}$

188   6
$\frac{3}{4}$ yd. = 10 $10\frac{1}{2}$
199   $4\frac{1}{2}$
12
2392

s. d.   hf. d.   2
3   $7\frac{1}{2}$=87)4785(55 yards
435
435
435

(8)...5½ gui.=

$$
\begin{array}{ccc}
£ & s. & d. \\
5 & 15 & 6 \\
2 & 6 & 6 \\
\end{array}
$$

$$108 \left\{ \begin{array}{l} 9)\overline{8 \quad 2 \quad 0} \\ \overline{12)18 \quad 0} \end{array} \right.$$

$$4)\overline{1 \quad 6} \text{ per gal.}$$

4½d. per quart

(9)...66 shillings = 33 florins.

$$33 \left\{ \begin{array}{l} \text{dwts.} \\ 3)240 = 1 \text{ lb. Troy} \\ \overline{11)80} \end{array} \right.$$

7 dwts. $6\frac{6}{11}$ grs.

(10)...

$$
\begin{array}{lccc}
 & £ & s. & d. \\
7 \text{ bullocks} & 80 & 0 & 0 \\
5s.\ 6d. \times 16 \times 7 = & 30 & 16 & 0 \\
\text{total cost} = & \overline{110} & \overline{16} & \overline{0} \\
\end{array}
$$

$$
\begin{array}{lccc}
 & £ & s. & d. \\
130 \text{ guineas} = & 136 & 10 & 0 \\
\text{cost} = & 110 & 16 & 0 \\
\text{profit } £ & \overline{25} & \overline{14} & \overline{0} \\
\end{array}
$$

EXERCISE XX.

(1)...   1. $973 - 462 + 197 - (149 + 76) + 1069 - 427$
$= 973 - 462 + 197 - 149 - 76 + 1069 - 427$
$= 2239 - 1114$
$= 1125$

2. $\{2469 - (210 - 173) + 2063 - 209 + 1545\} \div 17$
$= (2469 - 210 + 173 + 2063 - 209 + 1545) \div 17$
$= (6250 - 419) \div 17$
$= 5831 \div 17$
$= 343$

	t.	cwt.	qrs.	lb.	oz.	drs.
(2)...	29	11	1	15	7	10
	17	18	3	23	11	13
	11	12	1	19	11	13

(3)...£866 6 10¼ = 831689 far.
£11 17 4¼ = 11393 far.

$831689 \div 11393 = 73$

$$
\begin{array}{ccc}
\text{ac.} & \text{ro.} & \text{per.}
\end{array}
$$

(4)...
$$
\begin{array}{ccc}
29 & 3 & 29 \\
\end{array}
$$
$$
\begin{array}{r}
4 \\
\hline
119 \\
40 \\
\hline
4789 \\
30\tfrac{1}{4} \\
\hline
143670 \\
1197\tfrac{1}{4} \\
\hline
144867\tfrac{1}{4} \text{ sq. yards}
\end{array}
$$

(5)...
$$
\begin{array}{r}
\text{sec.} \\
60)947291 \\
\hline
60)15788 \quad 11 \text{ sec.} \\
\hline
24)263 \quad 8 \text{ min.} \\
\hline
10 \quad 23 \text{ hrs.}
\end{array}
$$

Ans. 10 da. 23 hrs. 8 min. 11 sec.

$$
\begin{array}{ccc}
\text{qrs.} & \text{bu.} & \text{pks.}
\end{array}
$$

(6)...
$$
\begin{array}{ccc}
4 & 4 & 3 \\
\end{array}
$$
$$
\begin{array}{r}
8 \\
\hline
36 \\
4 \\
\hline
147 \\
4 \\
\hline
3)588 \\
\hline
196 \text{ days}
\end{array}
$$

(7)...
$$
\begin{array}{r}
1 \text{ mile} = 1760 \text{ yards} \\
73\tfrac{1}{2} \\
\hline
5280 \\
12320 \\
880 \\
\hline
129360 \\
\end{array}
$$
£2 10s. = 50 sh.
$$
\begin{array}{r}
20)6468000 \\
\hline
£323400
\end{array}
$$

(8)...
$$
\begin{array}{r}
\text{gui.} \\
20 \\
21 \\
\hline
420 \\
12 \\
\end{array}
$$
3s. 9d. = 45d. $\left\{\begin{array}{r} 5)5040 \\ \hline 9)1008 \\ \hline 112 \text{ E. ells} \\ 5 \\ \hline 4)560 \\ \hline 140 \text{ yards} \end{array}\right.$

(9)...
$$
\begin{array}{r}
\text{pence} \\
6\tfrac{1}{2} \\
3 \times 9 = 27 \\
\hline
1 \quad 7\tfrac{1}{2} \\
9 \\
\hline
14 \quad 7\tfrac{1}{2} \\
\end{array}
$$
½ lb.
$$
\begin{array}{r}
3\tfrac{1}{4} \\
\hline
14 \quad 10\tfrac{3}{4} \text{ each box} \\
9 \\
\hline
£6 \quad 14 \quad 0\tfrac{3}{4}
\end{array}
$$

(10)...
	£	s.	d.
175 mince-pies at 3d. each =	2	3	9
175 buns at 14 for a shilling =		12	6
175 oranges at 9d. per dozen =		10	11¼
	£3	7	2¼

EXERCISE XXI.

(1)...   4863)1843077(379

14589

38417

34041

‾‾‾‾‾‾‾43767

43767

$\begin{array}{ccc} \pounds & s. & d. \end{array}$

(2)...553   7   8

20

‾‾‾‾11067

3

‾‾‾‾33203 fourpenny-pieces

sq. yds.

(3)...   94259

4

yds. qrs.

$30\frac{1}{4}=121\left\{\begin{array}{l} 11)\overline{377036} \\ 11)\overline{34276} \end{array}\right.$

40)3116

‾‾‾‾4)77   36 per.

‾‾19   1 rood

cu. in.

$(4)...1728\left\{\begin{array}{l} 12)\overline{1353024} \\ 12)\overline{112752} \\ 12)\overline{9396} \end{array}\right.$

$27\left\{\begin{array}{l} 3)\overline{783}\ \text{cu. ft.} \\ 9)\overline{261} \end{array}\right.$

29 cu. yds.

Ans. 19 ac. 1 ro. 36 per.

$\begin{array}{ccc} \pounds & s. & d. \end{array}$

$(5)...72\left\{\begin{array}{lll} 6)2 & 0 & 6 \\ \hline 12) & 6 & 9 \end{array}\right.$

$6\frac{3}{4}d.$ per yd.

$\begin{array}{cc} s. & d, \end{array}$

(6)...   19   7½

$6\times6\times10+5=365$

‾‾‾‾‾5   17   9

6

‾‾‾‾‾35   6   6

10

‾‾‾‾‾353   5   0

4   18   1½

‾‾‾‾‾£358   3   1½

ac. ro. per.

$(7)...25\left\{\begin{array}{lll} 5)5 & 1 & 35 \\ 5)\overline{1} & 0 & 15 \end{array}\right.$

35 perches

$\begin{array}{ccc} \pounds & s. & d. \end{array}$

450 gui. = 472   10   0

Annual expenditure = 358   3   1½

Annual savings = ‾‾‾114   6   10½

men men days

(8)...   8 : 10 :: 14 : x

$x = \dfrac{10\times14}{8} = 17\frac{1}{2}$ days

(9)...

$$\text{Loss on } \pounds 1 = \overset{s.}{7} \ \overset{d.}{3}$$

$$\overset{\pounds}{1} : \overset{\pounds\quad s.}{792\ \ 5} :: \overset{s.\quad d.}{7\ \ 3} : x$$

$$\begin{array}{ccc} 20 & 20 & 12 \\ \overline{20} & \overline{15845} & \overline{87} \end{array}$$

$$x = \frac{\overset{3169}{\cancel{15845}} \times 87}{\underset{4}{\cancel{20}}} = \overset{d.}{68925\tfrac{3}{4}} = \pounds 287 \ 3s. \ 9\tfrac{3}{4}d.$$

(10)...

$$\begin{array}{l} \text{4 daughters, each one share} = \text{4 shares} \\ \text{wife} = 3 \quad \text{,,} \\ \hline \qquad\qquad\qquad\qquad\qquad 7 \text{ shares} \end{array}$$

$$\overset{\pounds}{7)5250} = 5000 \text{ guineas}$$

$$\pounds 750 \text{ each daughter's portion}$$

$$\underline{\quad 3 \quad}$$

$$\pounds 2250 \text{ wife's portion}$$

EXERCISE XXII.

	ac.	ro.	po.	yds.
(1)...	27	2	15	26
	11	3	28	20
	15	2	27	6

(2)...		$\pounds$	$s.$	$d.$
	59 gui. =	61	19	0
	43 sov. =	43	0	0
	65 hf. cr. =	8	2	6
		113	1	6
		20		
		2261		
		12		
		27138 pence		

	wks.	da.	hrs.	min.
(3)...	37	5	19	35
	7			

$$\begin{array}{l} 264 \\ 24 \\ \hline 6355 \\ 60 \\ \hline 381335 \\ 60 \\ \hline 22880100 \text{ seconds} \end{array}$$

$$\begin{array}{l} \qquad\qquad\quad \text{gal.} \\ (4)... \quad 2)79596 \\ \qquad\quad 4)39798 \\ \qquad\qquad 8)9949 \quad 2 \text{ pks.} \\ \text{qrs. } 1243 \quad 5 \text{ bu. 2 pks.} \end{array}$$

(5)...

			s.	d.	£	s.	d.
6	lb.	black tea	3	10	= 1	3	0
1½	„	green „	4	8	=	7	0
8¼	„	coffee	1	8	=	13	9
14	„	lump sugar		6½	=	7	7
21	„	moist „		5	=	8	9
					£3	0	1

(6)...

$$
\begin{array}{ccccccc}
\text{yds.} & & \text{yds.} & & £ & s. & d. \\
17\tfrac{1}{2} & : & 29\tfrac{3}{4} & :: & 8 & 6 & 3 & : & x \\
4 & & 4 & & 20 \\
\hline
70 & & 119 & & 166 \\
& & & & 12 \\
& & & & \hline \\
& & & & 1995
\end{array}
$$

$$
x = \frac{119 \times \overset{57}{\cancel{1995}}}{\underset{2}{\cancel{70}}} = 3391\tfrac{1}{2}\,\overset{d.}{} = £14\ 2s.\ 7\tfrac{1}{2}d.
$$

(7)...

	£	s.	d.
cost price	13	19	5
required profit	3	3	0
selling price	17	2	5

$$
\begin{array}{ccccccc}
\text{lb.} & \text{oz.} & & \text{lb.} & & £ & s. & d. \\
73 & 6 & : & 1 & :: & 17 & 2 & 5 & : & x \\
& 16 & & 16 & & 20 \\
\hline
1174 & & & 16 & & 342 \\
& & & & & 12 \\
& & & & & \hline \\
& & & & & 4109
\end{array}
$$

$$
x = \frac{\overset{8}{\cancel{16}} \times \overset{7}{\cancel{4109}}}{\underset{587}{\cancel{1174}}} = 56d. = 4s.\ 8d.\ \text{per lb.}
$$

(8)...

$$
\begin{array}{ccccccccc}
\text{ac.} & \text{ro.} & \text{per.} & & \text{ac.} & & £ & s. & d. \\
175 & 2 & 20 & : & 1 & :: & 316 & 2 & 6 & : & x \\
4 & & & & 4 & & 20 \\
\hline
702 & & & & 4 & & 6322 \\
40 & & & & 40 & & 12 \\
\hline
28100 & & & & 160 & & 75870
\end{array}
$$

$$
x = \frac{\overset{8}{\cancel{160}} \times \overset{54}{\cancel{75870}}}{\underset{1405}{\cancel{28100}}} = 432\,\overset{d.}{} = £1\ 16s.\ \text{per acre.}
$$

(9)...Perimeter of ground $= (148\frac{1}{2} + 101\frac{1}{4}) \times 2 = 499\frac{1}{2}$ yards
$= 17982$ inches

Length of each hurdle 6 ft. 9 in. $= 81$ inches

$17982 \div 81 = 222$ hurdles

(10)...9 qrs. 5 bu. oats at 22 6 per qr. $= 10\ 16\ 6\frac{3}{4}$ B's debt
17 tons 9 cwt. coals at 11 8 per ton $= 10\ \ 3\ \ 7$ A's debt
B owes A $\overline{\ \ \ \ 12\ 11\frac{3}{4}}$

EXERCISE XXIII.

(1)...

cwt.	qrs.	lb.
19	3	23
13	1	19
43	2	15
16	1	26
12	0	17
tons 5 5	2	16

(2)...

```
      3059
       109
     27531
      3059
437)333431(763
      3059
      2753
      2622
      1311
      1311
```

(3)...

219 hf. cr. $= 27\ \ 7\ \ 6$
37 hf. gui. $= 19\ \ 8\ \ 6$
£ $\overline{7\ 19\ \ 0}$

(4)...

```
       sq. in.
144 { 12)55728
    { 12)4644
      9)387
      43 sq. yds.
```

(5)...

```
       ac. ro. per.
72 { 6)24  3   0
   { 12)4  0  20
       1  15 per.
```

(6)...

$$\begin{array}{cc} s. & d. \quad d. \\ 1 & 9 = 21 \end{array}$$

$$\begin{array}{r} 45 \\ \hline 105 \\ 84 \end{array}$$

$$3s.\ 9d. = 45\overline{)945}(21\ \text{lb.}$$

$$\begin{array}{r} 90 \\ \hline 45 \\ 45 \\ \hline \end{array}$$

(7)... $13 + 23 = 36$

$$\begin{array}{ccccc} & & & \text{ft.} & \text{in.} \\ 36 & : & 13 & :: & 25 \quad 6 \quad : \quad x \end{array}$$

$$\begin{array}{r} 12 \\ \hline 306 \end{array}$$

$$x = \frac{13 \times \overset{17}{\cancel{306}}}{\underset{2}{\cancel{36}}} = 110\tfrac{1}{2} = 9\text{ft. }2\tfrac{1}{2}\text{ in.}$$

$$\begin{array}{lcrr} & & \text{ft.} & \text{in.} \\ \text{whole line} & = & 25 & 6 \\ \text{shorter portion} & = & 9 & 2\tfrac{1}{2} \\ \hline \text{longer portion} & = & 16 & 3\tfrac{1}{2} \end{array}$$

(8)...

$$\begin{array}{lrrr} & s.\ d. & \pounds & s. \quad d. \\ 6\ \text{lb. at } 4\ 9 = & 1 & 8 \quad 6 \\ 45\ \text{,,} \quad 3\ 4 = & 7 & 10 \quad 0 \\ \hline 51\ \text{,,} \quad = & 8 & 18 \quad 6 \end{array}$$

$$\pounds 8\ 18\ 6 \div 51 = 3s.\ 6d.\ \text{per lb.}$$

(9)...

$$\begin{array}{rrr} \pounds & s. & d. \\ 84 & 0 & 0 \\ 11 \\ \hline 924 & 0 & 0 \\ \end{array}$$

$$\begin{array}{lrrr} 1\ \text{rood} = & 21 & 0 & 0 \\ 20\ \text{per.} = & 10 & 10 & 0 \\ 5\ \text{,,} \quad = & 2 & 12 & 6 \\ 2\tfrac{1}{2}\ \text{,,} \quad = & 1 & 6 & 3 \\ \hline \pounds 959 & 8 & 9 \end{array}$$

(10)...

$$\begin{array}{ccccccc} \text{yds.} & & \text{E. ells} & & \pounds & s. & d. \\ 15\tfrac{3}{4} & : & 47 & :: & 2 & 15 & 1\tfrac{1}{2} & : & x \\ 4 & & 5 & & 20 \\ \hline 63 & & 235 & & 55 \\ & & & & 12 \\ & & & & \overline{661} \\ & & & & 4 \\ & & & & \overline{2646} \end{array}$$

$$x = \frac{235 \times \overset{42}{\cancel{2646}}}{\underset{}{\cancel{63}}} = 9870 = \pounds 10\ 5s.\ 7\tfrac{1}{2}d.$$

EXERCISE XXIV.

(1)...$\pounds 3\ 12\ 6\tfrac{3}{4} = 3483$ far.

$\pounds 105\ 4\ 3\tfrac{3}{4} = 101007$ far.

$101007 \div 3483 = 29$ times

(2)...

$$\begin{array}{lr} & \text{days} \\ \text{Jan. contains} & 31 \\ \text{Feb.} \quad \text{,,} & 29 \\ \text{Mar.} \quad \text{,,} & 31 \\ \hline & 91 \\ & 24 \\ \hline & 364 \\ & 182 \\ \hline & 2184 \\ & 60 \\ \hline & 131040\ \text{min.} \end{array}$$

(3)...

$$\begin{array}{lrr} & & \text{sh.} \\ 30\ \text{gal. at } 15s. = & 450 \\ 42\ \text{,,} \quad 18s. = & 756 \\ \hline 72 \end{array}$$

$$72 \left\{ \begin{array}{r} 6\overline{)1206} \\ 12\overline{)201} \end{array} \right.$$

$$\overline{16s.9d.}$$

			s.	d.	£	s.	d.
(4)...	12 yds. silk at		3	6 =	2	2	0
	8 „ flannel at	1	8 =		13	4
	6 prs. stockings at	1	9 =		10	6
	3 „ gloves at		2	6 =		7	6

$$£3 \quad 13 \quad 4$$

	£	s.	d.
	5	0	0
	3	13	4
change =	£1	6	8

(5)...

$$\begin{array}{cccccc} \text{da.} & & \text{da.} & £ & s. & d. \\ 365 & : & 219 & :: & 7 & 17 & 6 \\ 5 & & 3 & & & & 3 \end{array}$$

$$5)\overline{23 \quad 12 \quad 6}$$
$$£4 \quad 14 \quad 6$$

(6)...

$$\begin{array}{r} 65 \text{ per minute} \\ 60 \\ \hline 3900 \text{ per hour} \\ 24 \\ \hline 15600 \\ 7800 \\ \hline 93600 \text{ per day} \\ 31 \\ \hline 93600 \\ 280800 \\ \hline 2901600 \end{array}$$

(7)...

$$\begin{array}{r} \text{yds.} \\ 126 \\ 12s. \, 6d. = 12\frac{1}{2} \text{ sh.} \\ \hline 1512 \\ 63 \\ \end{array}$$

$$\text{sh.} \left\{ \begin{array}{r} 5)\overline{1575} \\ 7)\overline{315} \\ \hline 45 \text{ dozen} \end{array} \right.$$
35

(8)...

$$\begin{array}{ccccccc} £ & s. & d. & & £ & s. & & s. \\ 5635 & 17 & 6 & : & 3757 & 5 & :: & 20 & : & x \\ 20 & & & & 20 \\ \hline 112717 & & & & 75145 \\ 12 & & & & 12 \\ \hline 1352610 & & & & 901740 \end{array}$$

$$x = \frac{901740 \times 20}{1352610} = \frac{40}{3} = 13s. \, 4d. \text{ in the } £.$$

(9)...
$$7+9+13=29$$

$$29 \quad : \quad 7 \quad :: \quad \overset{\pounds \; \; s. \; \; d.}{44 \; 11 \; \; 9} \quad : \quad x$$

$$\begin{array}{r} 20 \\ \hline 891 \\ 12 \\ \hline 10701 \end{array}$$

$$x=\frac{7\times \overset{369}{\cancel{10701}}}{\cancel{29}} = 2583d. = \pounds 10 \; 15s. \; 3d.$$

$$29 \quad : \quad 9 \quad :: \quad \overset{d.}{10701} \quad : \quad x$$

$$x=\frac{9\times \overset{369}{\cancel{10701}}}{\cancel{29}} = 3321d. = \pounds 13 \; 16s. \; 9d.$$

$$29 \quad : \quad 13 \quad :: \quad \overset{d.}{10701} \quad : \quad x$$

$$x=\frac{13\times \overset{369}{\cancel{10701}}}{\cancel{29}} = 4797d. = \pounds 19 \; 19s. \; 9d.$$

(10)...
$$3\tfrac{1}{2} \text{ miles} = 6160 \text{ yards}$$
$$1 \text{ mi. } 6 \text{ fur. } 120 \text{ yds.} = 3200 \text{ yards}$$

$$\overset{\text{yds.}}{6160} \quad : \quad \overset{\text{yds.}}{3200} \quad :: \quad \overset{\text{min.}}{60} \quad : \quad x$$

$$x=\frac{\overset{40}{\cancel{3200}} \times 60}{\underset{77}{\cancel{6160}}} = \overset{\text{min.}}{\frac{2400}{77}} = 31\tfrac{13}{77} \text{ minutes}$$

D

EXERCISE XXV.

			s.
(1)...	15 gui.	=	315
	25 sov.	=	500
	30 hf.-cr.	=	75
	50 sh.	=	50

$$\overline{940}$$
$$3$$
$$\overline{2820} \text{ fourp.}$$

(2)...
$$
\begin{array}{r}
257 \\
553 \\
\hline
771 \\
1285 \\
1285 \\
\end{array}
$$

$$79)\overline{142121}(1799$$
$$79$$
$$\overline{631}$$
$$553$$
$$\overline{782}$$
$$711$$
$$\overline{711}$$
$$711$$

(3)...2 oz. 17 dwts. 12 grs. = 1380 grains
155 oz. 5 dwts. = 74520 grains

74520 ÷ 1380 = 54 table spoons

	qrs.	lb.		lb.		£	s.	d.		
(4)...	2	10½	:	112	::	1	18	9½	:	x
	28			2		20				
	66			224		38				
	2					12				
	133					465				
						4				
						1862				

$$x = \frac{224 \times \overset{14}{\cancel{1862}}}{\cancel{133}} = 3136 \text{ far.} = \pounds3 \; 5s. \; 4d. \text{ per cwt.}$$

	lb.		cwt.	qr.	lb.		£	s.	d.		
(5)...	28	:	3	1	21	::	2	0	10	:	x
			4				20				
			13				40				
			28				12				
			385				490				

$$x = \frac{385 \times \overset{35}{\cancel{490}}}{\underset{2}{\cancel{28}}} = 6737\tfrac{1}{2}d. = \pounds28 \; 1s. \; 5\tfrac{1}{2}d.$$

(6)... $\quad$ 28 in. × 117 = 3276 in. = 91 yds. per minute

26 mi. = 26 × 1760 = 45760 yards

$91)45760(502\tfrac{6}{7}$ min. = 8 hrs. $22\tfrac{6}{7}$ min.

$$\begin{array}{r} 455 \\ \hline 260 \\ 182 \\ \hline 78 \\ \hline 91 \end{array} = \tfrac{6}{7}$$

(7)...

$$\begin{array}{ccccccc} \text{in.} & & \text{in.} & & \text{yds.} & & \\ 33 & : & 56 & :: & 45 & : & x \end{array}$$

$$x = \frac{56 \times \overset{15}{\cancel{45}}}{\underset{11}{\cancel{33}}} = \frac{\overset{\text{yds.}}{840}}{11} = 76\tfrac{4}{11} \text{ yards}$$

(8)... $\quad$ $82\tfrac{1}{4}$ lb. × 7 = $575\tfrac{3}{4}$ lb.

$$\begin{array}{ccccccccc} \text{lb.} & & \text{lb.} & & \pounds & s. & d. & & \\ 79\tfrac{1}{2} & : & 575\tfrac{3}{4} & :: & 13 & 18 & 3 & : & x \\ 4 & & 4 & & 20 & & & & \\ \hline 318 & & 2303 & & 278 & & & & \\ & & & & 12 & & & & \\ & & & & \hline & & & & \\ & & & & 3339 & & & & \end{array}$$

$$x = \frac{2303 \times \overset{21}{\cancel{3339}}}{\underset{2}{\cancel{318}}} = 24181\tfrac{1}{2}d. = \pounds100 \ 15s. \ 1\tfrac{1}{2}d.$$

(9)...
361 ac. 25 per.=57785 perches
2 a. 3 r. 15 per.=455 perches

57785÷455=127 portions

$$\begin{array}{cccc} & & & \pounds \quad s. \quad d. \\ (10)...9\tfrac{1}{2} \text{ gui.} & = & 9 & 19 \quad 6 \\ & & & 17 \\ & & \hline & \\ & & 169 & 11 \quad 6 \\ \text{Cash} & & 100 & 0 \quad 0 \\ & & \hline & \\ 66 \left\{ \begin{array}{l} 6)69 \ 11 \ 6 \\ 11)11 \ 11 \ 11 \end{array} \right. \\ \end{array}$$

value of each sheep $\pounds1$ $\quad1$ $\quad1$

EXERCISE XXVI.

(1)...

$$
\begin{array}{r}
17009053 \\
5040026 \\
\hline
102054318 \\
34018106 \\
68036212 \\
85045265 \\
\end{array}
$$

173794)85726069355378(493262537
$$
\begin{array}{r}
695176 \\
\hline
1620846 \\
1564146 \\
\hline
567009 \\
521382 \\
\hline
456273 \\
347588 \\
\hline
1086855 \\
1042764 \\
\hline
440915 \\
347588 \\
\hline
933273 \\
868970 \\
\hline
643037 \\
521382 \\
\hline
1216558 \\
1216588 \\
\hline
\end{array}
$$

(3)...   1 sov. + 1 hf.-sov. + 1 hf.-cr. + 1 fl. $=\overset{\text{£ s. d.}}{1\ 14\ 6}$

$= 69$ sixp.

£ s. d.
46 11 6
20
―――――
931
2
―――――
69)1863(27 of each
138
―――
483
483
―――

(2)...

756 $\left\{ \begin{array}{l} 7)5799\ 18\ 9 \\ \hline 9)828\ 11\ 3 \\ \hline 12)92\ 1\ 3 \\ \hline \end{array} \right.$ (£ s. d.)

£7 13 5¼

	da.	hrs.
(4)... June 18...	0	7
June 19 to July 31...43		0
Aug. 1...	0	9
	43	16
	24	
	188	
	86	
	1048 hours	

	£	s.	d.
(5)...	2	17	6
			$3 \times 9 = 27$
	8	12	6
			9
	77	12	6
2 bu. =	0	14	$4\frac{1}{2}$
1 bu. =	0	7	$2\frac{1}{4}$
2 pks. =	0	3	$7\frac{1}{8}$
£78		17	$7\frac{7}{8}$

(6)...

$$15 \text{ men,} \quad \text{each 2 shares} = 30 \text{ shares}$$
$$24 \text{ women, each 1 share} = 24 \quad \text{,,}$$
$$\overline{54} \quad \text{,,}$$

$$54 \left\{ \begin{array}{ll} \text{£} \quad s. \quad d. \\ 6)13 \quad 10 \quad 0 \\ \overline{9)2 \quad 5 \quad 0} \end{array} \right.$$
$$\overline{\quad 5 \quad 0} \text{ value of each share}$$

∴ each man will receive 10s., and each woman 5s.

(7)...

$$2 \text{ cwt. } 3 \text{ qrs. } 22 \text{ lb.} = 330 \text{ lb.}$$

$$330 \text{ lb. at } 6\frac{1}{2}d. \text{ per lb.} = \text{£}8 \text{ } 18s. \text{ } 9d.$$

£	s.	d.		£	s.	d.		lb.		
2	6	8	:	8	18	9	::	112	:	x
20				20						
46				178						
12				12						
560				2145						

$$x = \frac{\overset{429}{\cancel{2145}} \times \cancel{112}}{\underset{\cancel{5}}{\cancel{560}}} = 429 \text{ lb.} = 3 \text{ cwt. } 3 \text{ qrs. } 9 \text{ lb.}$$

	ft.	in.		ft.		ft.		
(8)...	6	2	:	185	::	5	:	x
	12			12				
	74			2220				

$$x = \frac{\overset{30}{\cancel{2220}} \times 5}{\cancel{74}} = 150 \text{ feet}$$

(9)...

$$37\tfrac{1}{2} \text{ yds.} \times 15 = 562\tfrac{1}{2} \text{ yds.}$$
$$45\tfrac{1}{2} \text{ yds.} \times 13 = 591\tfrac{1}{2} \text{ yds.}$$

	£	s.	d.
$562\tfrac{1}{2}$ yds. at $6\tfrac{1}{2}d.$ =	15	4	$8\tfrac{1}{4}$
$591\tfrac{1}{2}$ yds. at $7\tfrac{1}{2}d.$ =	18	9	$8\tfrac{1}{4}$
	£33	14	$4\tfrac{1}{2}$

(10)...

ac.		ac.	ro.	per.		bu.		
7	:	9	3	20	::	392	:	x
4		4						
28		39						
40		40						
1120		1580						

$$x = \frac{\overset{79}{\cancel{1580}} \times \overset{7}{\cancel{392}}}{\underset{5\cancel{0}}{\cancel{1120}}} = 553 \text{ bushels}$$

EXERCISE XXVII.

(1)...

mi.	fur.	po.	yds.	ft.
29	3	27	3	2

$$\begin{array}{r} 8 \\ \hline 235 \\ 40 \\ \hline 9427 \\ 5\tfrac{1}{2} \\ \hline 47138 \\ 4713\tfrac{1}{2} \\ \hline 51851\tfrac{1}{2} \\ 3 \\ \hline 155556\tfrac{1}{2} \\ 12 \\ \hline 1866678 \text{ inches} \end{array}$$

(2)...60)26347289   sec.

$$\begin{array}{r} 60)\overline{26347289} \\ \hline 60)\overline{439121} \quad 29 \text{ sec.} \\ \hline 24)\overline{7318} \quad 41 \text{ min.} \\ \hline 7)\overline{304} \quad 22 \text{ hrs.} \\ \hline 43 \quad 3 \text{ da.} \end{array}$$

Ans. 43 wks. 3 da. 22 hrs. 41 min. 29 sec.

(3)...

ac.	ro.
277	2
	2

$$37\tfrac{1}{2} \times 2 = 75 \left\{ \begin{array}{r} 5)\overline{555} \quad 0 \\ 5)\overline{111} \quad 0 \\ 3)\overline{22} \quad 0 \quad 32 \\ \hline 7 \text{ a. } 1 \text{ r. } 22 \text{ per.} \end{array} \right.$$

(4)...$1\frac{3}{4}$ in.$=7$ qr. in.

2 ft. $5\frac{3}{4}$ in.$=119$ qr. in.

$119 \div 7 = 17$ volumes

(5)...

	£	s.	d.	£	s.	d.
27 sheep at	1	18	6	=51	19	6
13 calves at	2	14	6	=35	8	6
				£87	8	0

(6)...

	£	s.	d.
	4	6	8
			7
	30	6	8
10 dwts. =	2	3	4
5 „ =	1	1	8
$2\frac{1}{2}$ „ =	0	10	10
	£34	2	6

(7)...

yds.		yds.		£	s.	d.		
$7\frac{3}{4}$	:	$37\frac{1}{2}$	::	3	5	$10\frac{1}{2}$	:	x
4		4		20				
31		150		65				
				12				
				790				
				4				
				3162				

$$x = \frac{150 \times \overset{102}{\cancel{3162}}}{\cancel{31}} = 15300 \text{ far.} = £15 \; 18s. \; 9d.$$

(8)...The receipts from those paying 1d. per week (the number being double that of the others) amount to half the sum received, i.e. to 7s. 4d. per week ; therefore, if each child paid 2d. per week, the weekly payments would be increased by this sum :—

	s.	d.
	14	8
	7	4
£1	2	0

(9)...April, May, and June together contain 91 days = 13 weeks.

	£	s.	d.
	1	7	6
		13	
	£17	17	6

(10)...   The train travels 80 yards in 5 seconds
$$\frac{12}{960}$$ yards per minute
$$\frac{60}{1760)57600}(32 \text{ mi. } 1280 \text{ yds.}$$
$$\frac{5280}{4800}$$
$$3520$$
$$\overline{1280} \text{ yards}$$

EXERCISE XXVIII.

	ac.	ro.	per.	yds.
(2)...	33	1	34	18

$$\frac{4}{133}$$
$$\frac{40}{5354}$$
$$30\tfrac{1}{4}$$
$$\overline{160638}$$
$$1338\tfrac{1}{2}$$
$$\overline{161976\tfrac{1}{2}}$$
$$9$$
$$\overline{1457788\tfrac{1}{2}} \text{ sq. feet}$$

	£	s.	d.
(1)...	25	8	9
17½ gui. =	18	7	6
	£6	16	3

qrs.	bu.		qrs.	bu.	pks.		da.		
(3)... 2	5	:	12	3	3	::	16	:	x

$$
\begin{array}{cc}
8 & 8 \\
\overline{21} & \overline{99} \\
4 & 4 \\
\overline{84} & \overline{399}
\end{array}
$$

$$x = \frac{\overset{19}{\cancel{399}} \times \overset{4}{\cancel{16}}}{\underset{1}{\cancel{\underset{1}{\cancel{84}}}}} = 76 \text{ days}$$

(4)...

					$s.$	$d.$		$£$	$s.$	$d.$
13	yds.	Sheeting	......	1	9	=	1	2	9	
$10\frac{1}{2}$	,,	Irish Linen	...	2	3	=	1	3	$7\frac{1}{2}$	
$6\frac{3}{4}$	,,	Flannel	....	1	10	=	0	12	$4\frac{1}{2}$	
2	doz.	Napkins	......	18	6	=	1	17	0	

$$£4 \quad 15 \quad 9$$

(5)...

	$£$	$s.$	$d.$
	2	6	8
			5
	11	13	4
2 qrs. =	1	3	4
7 lb. =	0	2	11
	£12	19	7

5 cwt. 2 qrs. 7 lb. = 623 lb.

$$6$$
$$12)\overline{3738}$$
$$20)\overline{311}\quad 6$$

		$£$	$s.$	$d.$
selling price		15	11	6
cost price		12	19	7
profit		£2	11	11

(6)...

gui.		$£$		$£$	$s.$	$d.$		
45	:	85	::	9	1	$1\frac{1}{2}$	:	x
21		20		90				
945		1700		181				
				12				
				2173				
				4				
				8694				

$$x = \frac{\overset{340}{\cancel{1700}} \times \overset{46}{\cancel{8694}}}{\underset{\cancel{5}}{\cancel{945}}} = 15640 \text{ far.} = £16 \; 5s. \; 10d.$$

(7)...

					$£$	$s.$
17 oxen at	£11	15s.	=		199	15
21 ,,	£13	13s.	=		286	13
					486	8

38 oxen at £13 2s. 6d. = £498 15s.

	$£$	$s.$
selling price	498	15
cost price	486	8
profit	£12	7

(8)...

$$
\begin{array}{rcc}
\text{yds.} & \text{ft.} & \text{in.} \\
125 & 2 & 0 \\
114 & 1 & 6 \\
89 & 2 & 3 \\
137 & 1 & 9 \\
\hline
467 & 1 & 6 = 467\tfrac{1}{2} \text{ yds.}
\end{array}
$$

$467\tfrac{1}{2}$ yds. at 1s. 6d. $= £35$ 1s. 3d.

(9)...

$$
\begin{array}{ccccccc}
\text{hrs.} & \text{min.} & & \text{hr.} & & \text{mi.} & \\
6 & 20 & : & 1 & :: & 23 & : & x \\
& 60 & & 60 & & & \\
\hline
& 380 & & 60 & & & \\
\end{array}
$$

$$
x = \frac{\overset{3}{\cancel{60}} \times 23}{\underset{19}{\cancel{380}}} = \frac{69}{19} \text{ miles} = 3 \text{ mi. } 5 \text{ fur. } 11\tfrac{11}{19} \text{ yds.}
$$

(10)...

$$
900 + 1250 + 1600 = 3750 \text{ men}
$$

$$
3750 : 900 :: 75 : x
$$

$$
x = \frac{\overset{18}{\cancel{900}} \times \cancel{75}}{\underset{50}{\cancel{3750}}} = 18 \text{ men}
$$

$$
3750 : 1250 :: 75 : x
$$

$$
x = \frac{\overset{25}{\cancel{1250}} \times \cancel{75}}{\underset{50}{\cancel{3750}}} = 25 \text{ men}
$$

$$
3750 : 1600 :: 75 : x
$$

$$
x = \frac{\overset{32}{\cancel{1600}} \times \cancel{75}}{\underset{50}{\cancel{3750}}} = 32 \text{ men}
$$

EXERCISE XXIX.

(1)...£19 12s. 9d. = 4713d.

£373 2s. 3d. = 89547d.

89547÷4713 = 19 times

$$\begin{array}{ccc} & \text{mi.} & \text{fur.} & \text{po.} \\ (2)...& 7 & 5 & 16 \\ & & & 8 \\ \hline & & & 61 \\ & & & 40 \\ \hline & & & 2456 \\ & & & 5\frac{1}{2} \\ \hline & & & 12280 \\ & & & 1228 \\ \hline & & & 13508 \text{ yards} \end{array}$$

(3)...

sq. yds.

67384

4

yds. qrs.

$30\frac{1}{4}=121$ $\left\{\begin{array}{l} 11)\overline{269536} \\ 11)\overline{24503}\ 3 \\ \quad 40)\overline{2227}\ 6 \end{array}\right\}$ 69 qrs.=$17\frac{1}{4}$ yds.

$\dfrac{4)\ \overline{55}\ 27\ \text{per.}}{13\ 3\ \text{ro.}}$

Ans. 13 ac. 3 ro. 27 per. $17\frac{1}{4}$ yds.

(4)...

$$\begin{array}{ccccccc} \text{hrs.} & & \text{hrs.} & & \text{min.} & & \\ 11\frac{1}{4} & : & 15\frac{3}{4} & :: & 5 & : & x \\ 4 & & 4 & & & & \\ \hline 45 & & 63 & & & & \end{array}$$

$$x = \frac{\overset{7}{\cancel{63}} \times \cancel{5}}{\underset{9}{\cancel{45}}} = 7 \text{ min.}$$

(5)... 3 cwt. 1 qr. 14 lb. × 7 = 23 cwt. 2 qrs. 14 lb.

$$\begin{array}{ccccccccc} \text{cwt.} & & \text{cwt.} & \text{qrs.} & \text{lb.} & & s. & d. & \\ 20 & : & 23 & 2 & 14 & :: & 16 & 8 & : & x \\ 4 & & 4 & & & & 12 & & \\ \hline 80 & & 94 & & & & 200 & & \\ 28 & & 28 & & & & & & \\ \hline 2240 & & 2646 & & & & & & \end{array}$$

$$x = \frac{\overset{189}{\cancel{2646}} \times \overset{5}{\cancel{200}}}{\underset{\underset{4}{\cancel{100}}}{\cancel{2240}}} = \frac{945}{4}d. = 19s.\ 8\frac{1}{4}d.$$

$$(6)...$$

	$d.$
	$4\frac{1}{2}$
	$4 \times 9 = 36$

$$\begin{array}{cc} 1 & 6 \\ & 9 \\ \hline 13 & 6 \text{ per piece} \\ 5 \times 5 & = 25 \\ \hline 3 & 7 & 6 \\ & 5 \\ \end{array}$$

$s.$	$d.$		16	17	6 selling price
12	$7\frac{1}{2} \times 25 = 15$		15	$7\frac{1}{2}$ cost price	

$$\pounds 1 \quad 1 \quad 10\frac{1}{2} \text{ profit}$$

$$(7)...$$

	po.	yds.
	25	16
		$5 \times 9 + 2 = 47$

$$\begin{array}{ccc} 3 & 7 & 19\frac{1}{2} \\ & & 9 \\ \hline 7 \quad 0 & 28 & 24\frac{1}{4} \\ 1 & 11 & 1\frac{3}{4} \\ \hline \end{array}$$

$$7 \text{ a. } 1 \text{ r. } 39 \text{ p. } 26 \text{ yds.}$$

$$(8)...$$

yds.		E. ells			$s.$	$d.$		
$19\frac{3}{4}$	:	$73\frac{1}{2}$	::		16	$5\frac{1}{2}$	:	x
4		5			12			
79		$367\frac{1}{2}$			197			
2		2			4			
158		735			790			

$$x = \frac{735 \times \overset{5}{\cancel{790}}}{\cancel{158}} = 3675 \text{ far.} = \pounds 3 \; 16s. \; 6\frac{3}{4}d.$$

$s.$	$d.$	$d.$
$(9)...3$	$8 = 44$	
	$79\frac{3}{4}$	
	396	
	308	
	33	
	3509	

$$\begin{array}{l} d. \;\; hf. \, d. \quad 2 \\ 5\frac{1}{2} = 11 \overline{)7018} \\ \hline \quad\quad 638 \text{ lb.} = 5 \text{ c. } 2 \text{ q. } 22 \text{ lb.} \end{array}$$

$(10)...$		$\pounds$	$s.$	$d.$
each suit		3	6	3
each rifle		5	5	0
		8	11	3
		$5 \times 5 \times 6 = 150$		
		42	16	3
				5
		214	1	3
				6
		$\pounds 1284$	7	6

EXERCISE XXX.

$$(1)...$$

	$\pounds$	$s.$	$d.$	
$27 \Big\{$	$3 \overline{)20}$	9	6	$= 19\frac{1}{2}$ gui.
	$9 \overline{)6}$	16	6	
	15	2 each		

(2)...

$$
1728 \begin{cases}
\text{cu. in.} \\
12)\overline{2316845} \\
\quad 12)\overline{193070} \quad 5 \\
\qquad 12)\overline{16089} \quad 2
\end{cases} \Big\} 1325 \text{ cu. in.}
$$

$$
27 \begin{cases}
\quad 3)\overline{1340} \quad 9 \\
\qquad 9)\overline{446} \quad 2 \\
\qquad\quad \overline{49} \quad 5
\end{cases} \Big\} 17 \text{ cu. ft.}
$$

Ans. 49 cu. yds. 17 cu. ft. 1325 cu. in.

(3)...

			s.	*d.*	£	*s.*	*d.*
4½	lb.	Tea...............	4	3	= 0	19	1½
8	„	Coffee...........	1	8	= 0	13	4
2½	„	Chocolate	2	6	= 0	6	3
14	„	Lump Sugar ...	0	6½	= 0	7	7
25	„	Moist „ ...	0	5½	= 0	11	5½
8	„	Currants	0	6	= 0	4	0
6	„	Raisins	0	7	= 0	3	6
					£3	5	3

(4)...

£	*s.*	*d.*
83	7	6
70	12	6
12	15	0	profit on each share
	6 × 6	= 36
76	10	0
		6
£459	0	0

(5)...

qrs.	lb.	lb.
2	24½	= 80½
		11
		885½
		8½
		7084
		442¾
	12)7526¾
	20)627 2¾
	£31 7*s.* 2¾*d.*

(6)...

$$
\begin{array}{cccc}
s. & d. & & £ \quad s. \quad d. \\
3 & 7½ & : & 11 \ 15 \ 7½ \quad :: \quad 1 \quad : \quad x \\
12 & & & 20 \\
\overline{43} & & & \overline{235} \\
4 & & & 12 \\
\overline{174} & & & \overline{2827} \\
& & & 4 \\
& & & \overline{11310}
\end{array}
$$

$$
x = \frac{11310}{174} = £65
$$

(7)...

$$
\begin{array}{rrr}
£ & s. & d. \\
1 & 18 & 6 \\
& & 5 \times 10 + 3 = 53 \\
\hline
9 & 12 & 6 \\
& & 10 \\
\hline
96 & 5 & 0 \\
5 & 15 & 6 \\
\hline
\end{array}
$$

7)102 0 6 value of 53 sheep

£14 11 6 value of each ox

(8)...

$$
\begin{array}{cc}
s. \quad d. \\
12 \quad 10\tfrac{1}{2} \\
12 \\
\hline
154 \\
4 \\
\hline
618
\end{array}
\quad : \quad
\begin{array}{c}
£ \quad s. \quad d. \\
1774 \quad 3 \quad 6 \\
20 \\
\hline
35483 \\
12 \\
\hline
425802 \\
4 \\
\hline
1703208
\end{array}
\quad :: \quad
\begin{array}{c}
£ \\
1
\end{array}
\quad : \quad x
$$

$$x = \frac{1703208}{618} = £2756$$

(9)...

$$
\begin{array}{lrrrrrr}
& & s. & d. & £ & s. & d. \\
75\tfrac{1}{2} \text{ lb. Black Tea} & \ldots 3 & 2 & = & 11 & 19 & 1 \\
10\tfrac{1}{2} \text{ ,, Green ,,} & \ldots 3 & 10 & = & 2 & 0 & 3 \\
\hline
86 & & & & 13 & 19 & 4
\end{array}
$$

$$
\begin{array}{lrrrrrr}
& & s. & d. & £ & s. & d. \\
86 \text{ lb. Mixed Tea} & \ldots 3 & 9 & = & 16 & 2 & 6 \\
& & & \text{cost} & 13 & 19 & 4 \\
\hline
& & & \text{profit} & £2 & 3 & 2
\end{array}
$$

(10)...

$$
\begin{array}{lrrrrr}
& s. & d. & £ & s. & d. \\
35 \text{ men, at} & 2 & 9 \text{ per day each} = & 4 & 16 & 3 \\
15 \text{ women, at} 1 & 6 & \text{ ,, \quad ,, } = & 1 & 2 & 6 \\
25 \text{ boys, at} & 1 & 2 \text{ \quad ,, \quad ,, } = & 1 & 9 & 2 \\
\hline
& & & 7 & 7 & 11 \text{ per day} \\
& & & & & 6 \\
\hline
& & & £44 & 7 & 6 \text{ per week}
\end{array}
$$

EXERCISE XXXI.

		grs.
Sulphate of iron	$\frac{1}{2}$ dr. =	30
Subcarbonate of potash	=	10
Myrrh	1 dr. =	60
Compound powder of aloes	$\frac{1}{2}$ dr. =	30

$$30)\overline{130}$$

weight of each pill = $4\frac{1}{3}$ grains

cwt.	qrs.	lb.	oz.
(2)... 19	3	23	11

4
$\overline{79}$
28
$\overline{655}$
158
$\overline{2235}$
16
$\overline{13421}$
2235
$\overline{35771}$ ounces

(3)...10 ft. 9 in. = 129 in.
4 ft. 3 in. = 51
$\overline{129}$
645
$\overline{6579}$ sq. inches

(4)... 60)473760 min.
24)7896
7)329
47 weeks

(5)...

$$36 \begin{cases} 6)17 \quad 3 \\ 6)\ 2 \quad 10\frac{1}{2} \end{cases}$$

$5\frac{3}{4}$ per yard

		s.	d.	£	s.	d.
6)... 26 yds.	Irish linen at 2	3	= 2	18	6
24 „	Calico at		$7\frac{1}{2}$ =	15	0
12 „	Sheeting at 1	$10\frac{1}{2}$	= 1	2	6
18 „	Flannel at 1	9	= 1	11	6
6 prs.	Stockings at 2	3	=	13	6
3 „	Gloves at 1	9	=	5	3
				£7	6	3

(7)...   1 cwt. 1 qr. 7 lb. ×15 = 19 cwt. 2 qrs. 21 lb.

$$
\begin{array}{rrr}
\pounds & s. & d. \\
2 & 11 & 4 \\
\end{array}
$$

$3 \times 6 + 1 = 19$

$$
\begin{array}{rrr}
\hline
7 & 14 & 0 \\
 & & 6 \\
\hline
46 & 4 & 0 \\
2 & 11 & 4 \\
\end{array}
$$

2 qrs. = 1 5 8
14 lb. = 6 5
7 lb. = 3 2½
£50 10 7½

(8)...16d. per gal. = 2d. per pint

1½ pint × 365 = 547½ pints
2
12)1095
20)91 3
£4 11s. 3d.

(9)...45 lb. at 14½ = 2 14 4½
    10 lb. at 4½ = 3 9
    55   2 18 1½

55 lb. at 16d. = 3 13 4
cost = 2 18 1½
profit = 15 2½

(10)...   30000
                    2
24 { 4)60000 gallons required daily
   { 6)15000
        2500 gallons per hour

EXERCISE XXXII.

(1)...   hf. cr.
                76
                30
1 fl. = 24 { 4)2280
          { 6)570
            95 florins

(2)... 19¾ gui. = 4977d.
£2633 13s. 3d. = 632079d.

632079 ÷ 4977 = 127 times

(3)...

$$
\begin{array}{r}
\text{lb.} \\
175 \\
17 \\
\hline
1225 \\
175 \\
\hline
2975 \text{ lb.} \\
2\tfrac{3}{4} \\
\hline
5950 \\
1487\tfrac{1}{2} \\
743\tfrac{3}{4} \\
\hline
12)8181\tfrac{1}{4} \\
20)681\ 9\tfrac{1}{4} \\
\hline
\pounds 34\ 1\ 9\tfrac{1}{4}
\end{array}
$$

(4)... 1 lb. troy = 5760 grains

$$
\begin{array}{r}
55 \\
\hline
28800 \\
28800 \\
\hline
7000)316800(45\tfrac{9}{35} \text{ lb. Av.} \\
28000 \\
\hline
36800 \\
35000 \\
\hline
1800 \\
\hline
7000 = \tfrac{9}{35}
\end{array}
$$

(5)... $9+10+11 = 30$

$\pounds 885 \div 30 = \pounds 29\ 10s.$

$\pounds 29\ 10s. \times 9 = \pounds 265\ 10s.$
$\pounds 29\ 10s. \times 10 = \pounds 295$
$\pounds 29\ 10s. \times 11 = \pounds 324\ 10s.$

(6)... 1 qt., 1 pt., and $\tfrac{1}{2}$ pt. = 7 hf. pts.

$52\tfrac{1}{2}$ gallons = 840 hf. pts.

$$
\begin{array}{r}
7)840 \\
12)120 \text{ of each size} \\
\hline
10 \text{ dozen of each}
\end{array}
$$

(7)...

s.	d.		gui.		E. ell		
5	7½	:	27½	::	1	:	x
12			21		5		
67			577½		5		
4			12				
270			6930				
			4				
			27720				

$$x = \frac{\overset{308}{\cancel{27720}} \times 5}{\underset{3}{\cancel{270}}} = \frac{1540}{3} \text{ qrs. } \tfrac{1}{3} = 513\tfrac{1}{3} \text{ qrs.} = 128 \text{ yds.}$$

(8)

ti.		ti.		ti.		
13	:	9	::	221	:	x

$$x = \frac{9 \times \overset{17}{\cancel{221}}}{\cancel{13}} = 153 \text{ times}$$

E

	hrs. min.		hr.		mi.	yds.		
(9)...	7 6	:	1	::	26	1100	:	x

$$\begin{array}{ccc} \text{hrs. min.} & \text{hr.} & \text{mi.} \\ 7 \quad 6 & 1 & 1760 \\ 60 & 60 & \overline{2660} \\ \overline{426} & \overline{60} & 182 \\ & & 26 \\ & & \overline{46860} \end{array}$$

$$x = \frac{60 \times \overset{110}{\cancel{46860}}}{\cancel{426}} = 6600 \text{ yds.} = 3\tfrac{3}{4} \text{ miles}$$

(10)...   3 qrs. 10½ lb. × 300 = 28350 lb.

$$\begin{array}{ccccc} \text{lb.} & & \text{lb.} & & s. \\ 112 & : & 28350 & :: & 63 & : & x \end{array}$$

$$x = \frac{\overset{2025}{\cancel{28350}} \times 63}{\underset{8}{\cancel{112}}} = \frac{127575}{8} \text{ sh.} = £797 \; 6s. \; 10\tfrac{1}{2}d.$$

EXERCISE XXXIII.

	£	s.	d.
(1)...	82	6	10½

7¾ × 4 = 31)329   7   6(£10 12s. 6d.
          310
           ‾19
          20
    31)387(12s.
       372
        ‾15
        12
    31)186(6d.
      186

	ac.	ro.	po.
(2)...137	2	37	

        4
     ‾550
      40
   22037
     30¼
  661110
   5509¼
 666619¼ sq. yds.

(3)

yds.	qrs.	na.		yd.		£	s.	d.		
39	2	3	:	1	::	23	3	0¼	:	x
4				4		20				
158				4		463				
4				4		12				
635				16		5556				
						4				
						22225				

$$x = \frac{16 \times \cancel{22225}^{35}}{\cancel{635}} = 560 \text{ far.} = 11s.\ 8d.\ \text{per yard}$$

(4)...

£	s.	d.		£	s.	d.		t.	cwt.	qrs.		
1	11	8	:	1	15	10	::	2	7	2	:	x
20				20				20				
31				35				47				
12				12				4				
380				430				190				

$$x = \frac{\cancel{430} \times \cancel{190}}{\cancel{380}_{\cancel{2}}} = 215 \text{ qrs.} = 2 \text{ tons } 13 \text{ cwt. } 3 \text{ qrs.}$$

(5)...

	s.	d.
1 ell at 10s. 6d. per yard =	13	1½
	11	3
profit on 1 ell =	1	10½

$$8 \times 7 = 56$$

	15	0
		7
£5	5	0

(6)...

$$2 \text{ ft. } 8 \text{ in.} \times 750 = 2000 \text{ feet}$$

$$12$$

$$3)\overline{24000} \text{ ft. per hour}$$

$$1760)\overline{8000}(4 \text{ mi. } 960 \text{ yds.}$$

$$\underline{7040}$$

$$\overline{960} \text{ yds.}$$

(7)...   388 sq. yds. 18 sq. in. = 502866 sq. in.
            25 yds. 1 ft. 9 in. = 921 in.   )

$$\begin{array}{cccccc} \text{sq. in.} & \text{in.} & & \text{in.} & \text{yds.} & \text{ft.} & \text{in.} \end{array}$$
$$502866 \div 921 = 546 = \begin{array}{ccc} 15 & 0 & 6 \end{array}$$

(8)...The extra time is one-seventh of the regular day's work, and, at the ordinary rate of payment, would be 8d. additional per day : hence—

$$\begin{array}{c} d. \\ 8 \\ 2 \\ \hline 1\quad 4 \\ 6 \\ \hline \end{array}$$

extra wages = $\overline{8s.\ 0d.}$ per week

(9)...
$$\begin{array}{ccccccccc} \text{ac.} & & \text{ac.} & \text{ro.} & \text{po.} & & \pounds & s. & d. \\ 1 & : & 353 & 2 & 20 & :: & 1 & 12 & 6 & : & x \\ 4 & & 4 & & & & 20 \\ \hline 4 & & 1414 & & & & 32 \\ 40 & & 40 & & & & 12 \\ \hline 160 & & 56580 & & & & 390 \end{array}$$

$$x = \frac{\overset{2829}{\cancel{56580}} \times \overset{195}{\cancel{390}}}{\underset{\underset{4}{\cancel{8}}}{\cancel{160}}} = \frac{551655}{4}d. = \pounds574\ 12s.\ 9\tfrac{3}{4}d.$$

(10)...Dividends $\begin{array}{cc} s. & d. \\ 7 & 6 \end{array} + \begin{array}{cc} s. & d. \\ 2 & 9 \end{array} + \begin{array}{cc} s. & d. \\ 1 & 6 \end{array} = \begin{array}{c} d. \\ 4\tfrac{1}{2} \end{array} = \begin{array}{cc} s. & d. \\ 12 & 1\tfrac{1}{2} \end{array}$ in the pound

$$\begin{array}{ccccccc} \pounds & & \pounds & & s. & d. \\ 1 & : & 3575 & :: & 12 & 1\tfrac{1}{2} & : & x \\ & & & & 12 \\ & & & & \hline & & & & 145 \\ & & & & 4 \\ & & & & \hline & & & & 582 \end{array}$$

$$x = 3575 \times 582 = 2080650 \text{ far.} = \pounds2167\ 6s.\ 10\tfrac{1}{2}d.$$

EXERCISE XXXIV.

(1)...
$$\begin{array}{r} 200006 \\ 20019 \\ \hline 179987 \end{array}$$

(2)...
$$\begin{array}{r} 9291 \\ 267 \\ \hline 65037 \\ 55746 \\ 18582 \\ \end{array}$$
$$489)\overline{2480697}(5073$$
$$\begin{array}{r} 2445 \\ \hline 3569 \\ 3423 \\ \hline 1467 \\ 1467 \\ \hline \end{array}$$

(3)...
$$\begin{array}{r} \text{yds.} \\ 146\frac{1}{4} \\ 4 \\ \hline 5)585 \\ \hline 117 \ \text{E. ells} \end{array}$$

(4)...
$$\begin{array}{cccc} \text{mi.} & \text{fur.} & \text{per.} & \text{yds.} \\ 19 & 5 & 19 & 2\frac{1}{2} \end{array}$$
$$\begin{array}{r} 8 \\ \hline 157 \\ 40 \\ \hline 6299 \\ 5\frac{1}{2} \\ \hline 31497\frac{1}{2} \\ 3149\frac{1}{2} \\ 34647 \\ 3 \\ \hline 103941 \\ 12 \\ \hline 1247292 \ \text{inches} \end{array}$$

(5)...$36\left\{\begin{array}{ccc} \pounds & s. & d. \\ 6)3 & 3 & 0 \\ 6) & 10 & 6 \\ \hline 4) & 1 & 9 \ \text{per gal.} \\ & & 5\frac{1}{4}d. \ \text{per qt.} \end{array}\right.$

(6)...
$$\begin{array}{ccc} s. & d. & d. \\ 4 & 3 & = 51 \\ & & 53 \\ \hline & & 153 \end{array}$$
$$\begin{array}{ccc} s. & d. & d. \ 255 \\ 3 & 9 & = 45)2703(60\frac{1}{15} \ \text{yds.} \\ & & 270 \\ & & \hline \ 3 \ = \frac{1}{15} \\ & & \overline{45} \end{array}$$

(7)...
$$\begin{array}{cccc} \text{da.} & \text{da.} & \text{hrs.} \\ 8\frac{3}{4} & : 10\frac{1}{2} & :: 7\frac{1}{2} & : x \\ 4 & 4 & 4 \\ \hline 35 & 42 & 30 \end{array}$$

$$x = \frac{\overset{6}{\cancel{42}} \times \overset{6}{\cancel{30}}}{\underset{5}{\cancel{35}}} = 36 \ \text{qrs.} = 9 \ \text{hrs.}$$

		da.	hrs.
(8)...	May 13...	0	18
May 14 to July 10...		58	0
	July 11...	0	18
		59	12
			24
		248	
		118	
		1428	hrs.

$11067 \div 1428 = 7\frac{3}{4}$ miles per hr.

	cwt.	qrs.	lb.
(9)...	3	2	10
			7
	25	0	14

		s.	d.
112 lb. at $5\frac{1}{2}d.$ =		51	4
cost per cwt. =		45	0
profit on 1 cwt. =		6	4
		$5 \times 5 = 25$	
	1	11	8
			5
	7	18	4
14 lb. =			$9\frac{1}{2}$
	£7	19	$1\frac{1}{2}$

		t.	cwt.	qr.
(10)...	weight of loaded truck =	4	1	1
	weight of truck =	1	5	0
	weight of parcels =	2	16	1

2 tons 16 cwt. 1 qr. = 6300 lb.

$6300 \div 360 = 17\frac{1}{2}$ lb.

EXERCISE XXXV.

		£	s.	d.
(1)...	17 hf. gui. =	8	18	6
	17 hf. sov. =	8	10	0
	17 hf. cr. =	2	2	6
	17 sixp. =	0	8	6
	17 hf. pence =	0	0	$8\frac{1}{2}$
		20	0	$2\frac{1}{2}$
			20	
		400		
			12	
		4802		
			4	
		19210 far.		

	wks.	da.	hrs.	min.
(2)...	43	4	20	43
	7			
	305			
	24			
	1240			
	610			
	7340			
	60			
	440443			
	60			
	26426580 seconds			

(3)...

$$
\begin{array}{lrr}
 & \text{da.} & \text{hrs.} \\
1 \text{ year} = & 365 & 6 \\
 & & 13 \\
\hline
 & 4748 & 6 \\
 & 176 & 0 \\
\hline
 & 4924 & 6 \\
 & 24 \\
\hline
 & 19702 \\
 & 9848 \\
\hline
 & 118182 \\
 & 60 \\
\hline
 & 7090920 & \text{minutes}
\end{array}
$$

(4)...

£296 19 8¾=285107 far.
£9 11 7¼=9197 far.

285107÷9197 = 31

(5)...269 mi. 9 po.=86089 po.
11 mi. 5 fur. 23 po.=3743 po.

86089÷3743 = 23

(6)... 14 : 164 :: 273 : x

$$x = \frac{\cancel{164}^{82} \times \cancel{273}^{39}}{\cancel{14}_{\cancel{7}_2}} = 3198$$

(7)... The money must be divided into 5 parts—

$$
\begin{array}{lrrr}
 & £ & s. & d. \\
5)& 13 & 2 & 6 \\
\hline
 & 2 & 12 & 6 \text{ each smaller} \\
 & & & 3 \quad \text{[portion} \\
\hline
 & £7 & 17 & 6 \text{ larger portion}
\end{array}
$$

(8)...

$$
\begin{array}{r}
d. \\
15 \\
56 \\
\hline
90 \\
75 \\
\end{array}
$$

s. d. d.
4 8=56)840(15 lb. of tea
      56
      ___
      280
      280
      ___

(9)...

				s.	d.	£	s.	d.
17	yds.	Silk	at	4	6	=3	16	6
25	„	Linen	„	1	7½	=2	0	7½
14½	„	Flannel	„	1	6	=1	1	9
35	„	Calico	„	0	4½	=0	13	1½
						£7	12	0

(10)...

Dividends 3 7½ + 2 6 + 1 8½ = 7 10 in the £
Loss = 20s.—7s. 10d. = 12s. 2d. in the £

$$
\begin{array}{rccccc}
£ & & £ & s. & d. & & s. & d. & \\
1 & : & 527 & 12 & 6 & :: & 12 & 2 & : \ x \\
8 & & 8 & & & & 12 & \\
\hline
8 \text{ hf. cr.} & & 4221 \text{ hf. cr.} & & & & 146 \\
\end{array}
$$

73

$$x = \frac{4221 \times \cancel{146}}{\cancel{8}_4} = \frac{308133}{4}d. = £320 \ 19s. \ 5¼d.$$

EXERCISE XXXVI.

(1)...
$$
\begin{array}{r}
5876425 \\
478 \\
\end{array}
$$

$6039)\overline{5875947}(973$

$$
\begin{array}{r}
54351 \\
\hline
44084 \\
42273 \\
\hline
18117 \\
18117 \\
\hline
\end{array}
$$

(2)...

		da.	hrs.
Sept.	1863	1	3
Oct.	„	31	0
Nov.	„	30	0
Dec.	„	31	0
Jan.	1864	31	0
Feb.	„	29	0
Mar.	„	24	10

$$
\begin{array}{r}
\overline{177 \quad 13} \\
24 \\
\hline
\overline{4261} \text{ hours}
\end{array}
$$

(3)...
$$17\tfrac{1}{2} \text{ miles} = 30800 \text{ yds.}$$
$$30800 \text{ yds.} \times 27\tfrac{1}{2} \text{ yds.} = 847000 \text{ sq. yds.}$$
$$847000 \div 4840 = 175 \text{ acres}$$

(4)...240 oranges at   8 for 6$d.$ = 15 $s.$

240   „   12 for 6$d.$ = 10

$$
\begin{array}{r}
\overline{480} \\
\end{array}
\qquad
\begin{array}{r}
\overline{25} \\
\end{array}
$$

480 oranges at 16 for 1$s.$ = 30 $s.$

                cost 25

               profit $\overline{5s.}$

(5)...1 yd. Matting = 3 ft. $\times$ 2$\tfrac{1}{2}$ ft.

                  = 7$\tfrac{1}{2}$ sq. ft.

$$
\begin{array}{r}
\text{ft.} \\
66 \\
30 \\
\hline
1980 \text{ sq. ft.} \\
\end{array}
$$

$$7\tfrac{1}{2} \times 2 = 15)\overline{3960}\,(264 \text{ yds.}$$

(6)...   4 cwt. 3 qrs. 17$\tfrac{1}{2}$ lb. $\times$ 7 = 34 cwt. 1 qr. 10$\tfrac{1}{2}$ lb.

lb.		cwt.	qr.	lb.		£	s.		
112	:	34	1	10$\tfrac{1}{2}$	::	2	2	:	x
2		4				20			

$$
\begin{array}{r}
\overline{224} \qquad \overline{137} \qquad \overline{42} \\
28 \\
\hline
\overline{3846} \\
2 \\
\hline
\overline{7693} \\
\end{array}
$$

$$x = \frac{\overset{3}{\cancel{7693}} \times \cancel{42}}{\underset{16}{\cancel{224}}} = \frac{23079}{16}\, s. = £72\ 2s.\ 5\tfrac{1}{4}d.$$

(7)...

	£	s.	d.
	13	16	8
			6
	83	0	0
2 rooas =	6	18	4
20 poles =	1	14	7
5 poles =	0	8	7¾
	£92	1	6¾

(8)...

$$3\tfrac{3}{4} \;:\; 35\tfrac{1}{4} \;::\; 1 \;:\; x$$

(min.) (min.) (hrs.)

$$\begin{array}{cc} 3\tfrac{3}{4} & 35\tfrac{1}{4} \\ 4 & 4 \\ \hline 15 & 141 \end{array}$$

$$x = \frac{\cancel{141}^{47}}{\cancel{15}_{5}} = \frac{47}{5} \text{ hrs.} = 9 \text{ hrs. } 24 \text{ min.}$$

(9)...

E. ells		yds.		£	s.	d.	
37	:	42¾	::	6	18	9	: x
5		4		20			
185		171		138			
				12			
				1665			

$$x = \frac{171 \times \cancel{1665}^{9}}{\cancel{185}} = 1539d. = £6 \; 8s. \; 3d.$$

(10)...

$$7 + 13 + 17 + 19 = 56$$

$$56 \left\{ \begin{array}{l} 7)\underline{577 \;\; 10 \;\; 0} = 550 \text{ guineas} \\ 8)\underline{82 \;\; 10 \;\; 0} \\ £10 \;\; 6 \;\; 3 \end{array} \right.$$

(£ s. d.)

£10 6s. 3d. × 7 = £72 3s. 9d.

£10 6s. 3d. × 13 = £134 1s. 3d.

£10 6s. 3d. × 17 = £175 6s. 3d.

£10 6s. 3d. × 19 = £195 18s. 9d.

EXERCISE XXXVII.

	mi.	fur.	per.	yds.
(1)...	17	7	25	$3\frac{1}{2}$

$$\begin{array}{r} 8 \\ \hline 143 \\ 40 \\ \hline 5745 \\ 5\frac{1}{2} \\ \hline 28728\frac{1}{2} \\ 2872\frac{1}{2} \\ \hline 31601 \\ 3 \\ \hline 94803 \\ 12 \\ \hline 1137636 \text{ inches} \end{array}$$

Proof.

in.

$$\begin{array}{r} 12)1137636 \\ \hline 3)\ \ 94803 \\ \hline 31601 \\ 2 \end{array}$$

$5\frac{1}{2} \times 2 = 11)\overline{63202}$

$40)\overline{5745}$ 7 hf. yds. $= 3\frac{1}{2}$ yds.

$8)\overline{143}$ 25 per.

     $\overline{17}$ 7 fur.

17 mi. 7 fur. 25 per. $3\frac{1}{2}$ yds.

(2)...

$$\begin{array}{r} 937 \\ 716 \\ \hline 5622 \\ 937 \\ 6559 \\ \end{array}$$

$179)\overline{670892}(3748$

$$\begin{array}{r} 537 \\ \hline 1338 \\ 1253 \\ \hline 859 \\ 716 \\ \hline 1432 \\ 1432 \\ \hline \end{array}$$

	s.	d.	d.
(3)...	4	6=	54

$$\begin{array}{r} 75 \\ \hline 270 \\ 378 \end{array}$$

s. d.   d.

37 6=$450)\overline{4050}(9$ dozen

    $\underline{4050}$

(4)...2 cwt. 3 qrs. 24 lb.$=332$ lb.

$4\frac{1}{2}d.$

$$\begin{array}{r} \hline 1328 \\ 166 \\ \hline 12)1494 \\ 20)\overline{124} \quad 6 \\ \hline £6 \quad 4s. \quad 6d. \end{array}$$

$$\text{(5)}\ldots \quad \overset{\pounds}{12560} \ : \ \overset{\pounds}{1} \ :: \ \overset{\pounds\quad s.}{706\ 10} \ : \ x$$

$$\begin{array}{r} 20 \\ \hline 14130 \end{array}$$

$$x = \frac{\overset{9}{\cancel{14130}}}{\underset{8}{\cancel{12560}}} = \frac{9}{8}s. = 1s.\ 1\tfrac{1}{2}d.\ \text{in the pound}$$

$$\text{(6)}\ldots \qquad 1\ \text{mile} = 1760\ \text{yards}$$

$$\begin{array}{r} 27 \\ \hline 12320 \\ 3520 \\ \hline 47520 \end{array}$$

$$2\tfrac{1}{2}\ \text{gui.} = \begin{array}{r} 52\tfrac{1}{2}s. \\ \hline 95040 \\ 237600 \\ 23760 \\ \hline \end{array}$$

$$20)\overline{2494800}$$
$$\pounds124740$$

$$\text{(7)}\ldots \quad \overset{\text{lb.}}{112} \ : \ \overset{\text{lb.}}{63\tfrac{1}{2}} \ :: \ \overset{\pounds\ \ s.}{4\ 18} \ : \ x$$

$$\begin{array}{ccc} 2 & 2 & 20 \\ \hline 224 & 127 & 98 \end{array}$$

$$x = \frac{127 \times \overset{7}{\cancel{98}}}{\underset{16}{\cancel{224}}} = \frac{889}{16}s. = \pounds2\ 15s.\ 6\tfrac{3}{4}d.$$

$$\text{(8)}\ldots \quad 11+13 = 24$$

$$24\ :\ 11\ ::\ 1752\ :\ x$$

$$x = \frac{11 \times \overset{73}{\cancel{1752}}}{\underset{}{\cancel{24}}} = 803$$

$$1752 - 803 = 949$$

$$\text{(9)}\ldots 32\tfrac{1}{2}\ \text{yds.} = 26\ \text{E. ells}$$

$$\begin{array}{lrrr} & \pounds & s. & d. \\ 26\ \text{ells at } 10s. = & 13 & 0 & 0 \\ \text{cost} = & 10 & 16 & 8 \\ \hline \text{profit} & \pounds2 & 3 & 4 \end{array}$$

		s.	d.	£	s.	d.
(10)...	3 doz. Port	44	0 =	6	12	0
	6 „ Sherry	36	0 = 10	16	0
	2 „ Marsala......	31	6 =	3	3	0
	4 „ Madeira ...	54	0 = 10	16	0
	3 „ Champagne	78	0 = 11	14	0
	4 „ Claret	66	0 = 13	4	0

$$£56 \quad 5 \quad 0$$

EXERCISE XXXVIII.

(1)...

cu. yds. cu. ft.

$$
\begin{array}{rr}
19 & 13 \\
27 & \\
\hline
146 & \\
38 & \\
\hline
526 & \\
1728 & \\
\hline
4208 & \\
1052 & \\
3682 & \\
526 & \\
\hline
908928 & \text{cu. inches}
\end{array}
$$

(2)...

reams

$$
\begin{array}{r}
125 \\
20 \\
\hline
2500 \\
24 \\
\hline
10000 \\
5000 \\
\hline
60000 \text{ sheets}
\end{array}
$$

(3)...

lb.		lb.		£	s.	
112	:	$43\frac{1}{2}$	::	3	10	: x
2		2		20		
224		87		70		

$$x = \frac{87 \times \overset{5}{\cancel{70}}}{\underset{16}{\cancel{224}}} = \frac{435}{16} \text{ sh.} = £1 \ 7s. \ 2\frac{1}{4}d.$$

(4)...

cwt.		cwt.		mi.		
$3\frac{3}{4}$	:	$2\frac{1}{4}$	::	75	:	x
4		4				
15		9				

$$x = \frac{9 \times \overset{5}{\cancel{75}}}{\cancel{15}} = 45 \text{ miles}$$

(5)...

$$
\begin{array}{cc}
s. & d. \\
17 & 6 \\
\end{array}
$$

$4 \times 9 \times 10 + 5 = 365$

$$
\begin{array}{ccc}
3 & 10 & 0 \\
 & & 9 \\
\hline
31 & 10 & 0 \\
 & & 10 \\
\hline
315 & 0 & 0 \\
4 & 7 & 6 \\
\hline
319 & 7 & 6 \quad \text{annual expenditure} \\
\end{array}
$$

$2 \text{ gui.} \times 12 = \begin{array}{ccc} 25 & 4 & 0 \end{array}$ annual savings

$£344 \quad 11 \quad 6$ annual income

(6)...
$$
\begin{array}{lll}
 & s.\ d. & s.\quad d. \\
52 \text{ lb. at} & 4\ 0 = & 208\ \ 0 \\
78 \text{ lb. at} & 4\ 5 = & 344\ \ 6 \\
\hline
130 \text{ lb.} & 130) & 552\ \ 6 (4s.\ 3d. \\
 & & 520 \\
 & & \overline{\quad 32} \\
 & & \quad 12 \\
 & & 130) \overline{390} (3d. \\
 & & \quad 390 \\
\end{array}
$$

(7)...
$$
\begin{array}{ccccc}
£ & s. & & s. & \\
3576 & 15 & : & 20 & :: \\
 & 20 & & & \\
\hline
71535 & & & & \\
\end{array}
\qquad
\begin{array}{ccc}
£ & s. & d. \\
1296 & 11 & 5\frac{1}{4} \quad : \quad x \\
 & 20 & \\
\hline
25931 & & \\
 & 12 & \\
\hline
311177 & & \\
 & 4 & \\
\hline
1244709 & & \\
\end{array}
$$

$$
x = \frac{\overset{4}{\cancel{20}} \times \overset{87}{\cancel{1244709}}}{\underset{\cancel{14307}}{\cancel{71535}}} = 348 \text{ far.} = 7s.\ 3d. \text{ in the } £
$$

(8)...
$$
\begin{array}{cccc}
t. & cwt. & qrs. & lb. \\
2 & 7 & 2 & 3\frac{1}{2} \\
\end{array}
$$

$45 \text{ lb.} \times 13 = \begin{array}{cccc} & 5 & 0 & 25 \end{array}$

net weight $= \begin{array}{cccc} 2 & 2 & 1 & 6\frac{1}{2} \end{array}$

(9)...
$$
\begin{array}{llrrrr}
 & & s. & d. & £ \ s. & d. \\
6 \text{ prs. Stockings at} & 2 & 6 = & 0 & 15 & 0 \\
3 \quad \text{„} \quad \text{Drawers at} & 4 & 9 = & 0 & 14 & 3 \\
4 \quad \text{„} \quad \text{Gloves at} & 2 & 3 = & 0 & 9 & 0 \\
3 \text{ Handkerchiefs} & 4 & 6 = & 0 & 13 & 6 \\
\hline
 & & & & £2 \ 11 & 9 \\
\end{array}
$$

$$
\begin{array}{ccc}
£ & s. & d. \\
3 & 0 & 0 \\
2 & 11 & 9 \\
\end{array}
$$

change $\overline{\quad 8s.\ 3d.}$

(10)...

$$17 + 14 + 11 = 42$$
$$21s. \div 42 = 6d.$$
$$6d. \times 17 = 8s.\ 6d.$$
$$6d. \times 14 = 7s.$$
$$6d. \times 11 = 5s.\ 6d.$$

EXERCISE XXXIX.

(1)...

	£	s.	d.
59 gui. =	61	19	0
107 sov. =	107	0	0
179 hf. cr. =	22	7	6
	£191	6	6

415 hf. gui. =	217	17	6
	191	6	6
	£26	11	0

(2)...473 + 116 = 589 greater no.

$$473$$
$$\overline{1767}$$
$$4123$$
$$2356$$
$$\overline{278597}$$

(3)...

yds.		yds.		sq. yds.
272	×	242	=	65824

$$65824$$
$$4$$

$$30\tfrac{1}{4} \times 4 = 121 \begin{cases} 11)\overline{263296} \\ 11)\overline{23936} \end{cases}$$
$$40)\overline{2176}$$
$$\overline{4)54}\ 16\ \text{per.}$$

13 ac. 2 ro. 16 per.

(4)...

	s.	d.
1 qu. =	28	0
2 bu. =	7	0
1 bu. =	3	6
1 pk. =	0	10½
	11	4½d.

(5)...

cwt.	qrs.	lb.		lb.		£	s.	d.		
1	3	27½	:	1	::	15	7	3¾	:	x
4				2			20			
7				2			307			
28							12			
223							3687			
2							4			
447							14751			

$$x = \frac{2 \times \cancel{14751}^{33}}{\cancel{447}} = 66\ \text{far.} = 1s.\ 4\tfrac{1}{2}d.\ \text{per lb.}$$

(6)...1 cwt. 2 qrs. 16 lb. × 3 = 4 cwt. 3 qrs. 20 lb. = 552 lb.

$$
\begin{array}{cccccc}
\text{lb.} & & \text{lb.} & & s. & d. \\
72 & : & 552 & :: & 2 & 3 & : & x \\
& & & & 12 & \\
\hline
& & & & 27 &
\end{array}
$$

$$x = \frac{\overset{69}{\cancel{552}} \times \overset{3}{\cancel{27}}}{\underset{\underset{8}{\cancel{72}}}{}} = 207d. = 17s.\ 3d.$$

(7)... 2 tons 17 cwt. 2 qrs. × 12 = 34½ tons

$$
\begin{array}{cc}
s. & d. \\
13 & 4 \\
& \quad 3 \times 11 + 1\tfrac{1}{2} = 34\tfrac{1}{2} \\
\hline
40 & 0 \\
& 11 \\
\hline
440 & 0 \\
13 & 4 \\
6 & 8 \\
\end{array}
$$

$$48 \begin{cases} 4)\overline{460 \quad 0} \\ 12)\overline{115} \end{cases}$$

$9\frac{7}{12}$ doz. = 9 doz. 7 bot.

(8)...

$$
\begin{array}{lccc}
& \pounds & s. & d. \\
& 1 & 15 & 0 \\
& & & 5 \\
\hline
& 8 & 15 & 0 \\
2\ \text{qrs.} = & 0 & 17 & 6 \\
14\ \text{lb.} = & 0 & 4 & 4\tfrac{1}{2} \\
7\ \text{lb.} = & 0 & 2 & 2\tfrac{1}{4} \\
\hline
& \pounds 9 & 19 & 0\tfrac{3}{4}
\end{array}
$$

5 cwt. 2 qrs. 21 lb. = 637 lb.

$$
\begin{array}{r}
4\tfrac{1}{2}d. \\
\hline
2548 \\
318\tfrac{1}{2} \\
\hline
12)2866\tfrac{1}{2} \\
20)238\ \ 10\tfrac{1}{2} \\
\end{array}
$$

$$
\begin{array}{lrrr}
\text{selling price} & 11 & 18 & 10\tfrac{1}{2} \\
\text{cost price} & 9 & 19 & 0\tfrac{3}{4} \\
\hline
\text{profit} & \pounds 1 & 19 & 9\tfrac{3}{4}
\end{array}
$$

(9)...
feet
1142
$4\frac{1}{2}$
4568
571
3)5139
1713 yds.

(10)...Dividends $4\ 7\frac{1}{2}+3\ 8\frac{1}{2}+1\ 11=10\ 3$ (s. d.)

$20s.-10s.\ 3d.=9s.\ 9d.$ loss in the £

$$\begin{array}{ccccccc} £ & & £ & s. & & s. & d. \\ 1 & : & 175 & 10 & :: & 9 & 9 & : & x \\ 20 & & 20 & & & 12 \\ \hline 20 & & 3510 & & & 117 \end{array}$$

$$x=\frac{\overset{351}{\cancel{3510}}\times 117}{\underset{2}{\cancel{20}}}=\frac{41067}{2}\,d.=£85\ 11s.\ 1\frac{1}{2}d.$$

EXERCISE XL.

(1)...
$$\begin{array}{cccccccc} lb. & oz. & lb. & oz. & lb. & oz. & lb. & oz. \\ 3 & 6+4 & 10+6 & 14 & = & 14 & 14 & = 238\ ounces \end{array}$$

7 cwt. 1 qr. 21 lb. = 13328 ounces

$11328 \div 238 = 56$ of each

$$\begin{array}{llcccccc} & & & s. & d. & £ & s. & d. \\ 18\frac{1}{2}\ yds. & Calico & \ldots\ldots & 0 & 7 & = 0 & 10 & 9\frac{1}{2} \\ 11 & „ & Muslin & \ldots\ldots & 1 & 3 & = 0 & 13 & 9 \\ 4\frac{1}{2} & „ & Diaper & \ldots\ldots & 1 & 9 & = 0 & 7 & 10\frac{1}{2} \\ 7\frac{1}{4} & „ & Bro. Holland & \ldots & 0 & 11 & = 0 & 6 & 7\frac{3}{4} \\ 15 & „ & Flannel & \ldots\ldots & 1 & 7 & = 1 & 3 & 9 \\ & & & & & £3 & 2 & 9\frac{3}{4} \end{array}$$

(3)...120 gui. =
$$\begin{array}{ccc} £ & s. & d. \\ 126 & 0 & 0 \\ 25 & 12 & 6 \\ \hline 100 & 7 & 6 \\ 20 \\ \hline 2007 \\ 12 \\ \hline 365)24090\,(66d.=5s.\ 6d. \\ 2190 \\ \hline 2190 \\ 2190 \end{array}$$

(4)...
$$\begin{array}{ccc} min. & min. & hrs. \\ 7 & : 5 :: & 19\frac{1}{4} \\ & & 4 \\ & & 77 \end{array}$$

$$x=\frac{5\times 77}{7}=55\ qrs.=13\frac{3}{4}\ hours$$

(5)...

cwt.	qr.	lb.		cwt.	qrs.	lb.		£	s.	d.		
3	1	10½	:	3	3	17	::	7	0	5¼	:	x

$$\begin{array}{ccc}
3\ \ 1\ \ 10\frac{1}{2} & 3\ \ 3\ \ 17 & 7\ \ 0\ \ 5\frac{1}{4} \\
4 & 4 & 20 \\
\overline{13} & \overline{15} & \overline{140} \\
28 & 28 & 12 \\
\overline{374} & \overline{437} & \overline{1685} \\
2 & 2 & 4 \\
\overline{749} & \overline{874} & \overline{6741}
\end{array}$$

$$x = \frac{874 \times \overset{9}{\cancel{6741}}}{\cancel{749}} = 7866 \text{ far.} = £8\ 3s.\ 10\frac{1}{2}d.$$

(6)...

£	s.	d.		£	s.	d.		cwt.	qrs.	lb.		
6	11	5	:	9	3	8	::	2	3	24	:	x

$$\begin{array}{ccc}
6\ \ 11\ \ 5 & 9\ \ 3\ \ 8 & 2\ \ 3\ \ 24 \\
20 & 20 & 4 \\
\overline{131} & \overline{183} & \overline{11} \\
12 & 12 & 28 \\
\overline{1577} & \overline{2204} & \overline{332}
\end{array}$$

$$x = \frac{\overset{116}{\cancel{2204}} \times \overset{4}{\cancel{332}}}{\underset{\underset{83}{\cancel{1577}}}{\cancel{1577}}} = 464 \text{ lb.} = 4 \text{ cwt. } 16 \text{ lb.}$$

(7)...

$$3 + 5 + 7 = 15$$

				£	s.
$\cancel{3}$	:	$\cancel{15}$	::	2753	10
		5			5

£13767 10s. value of property

				£	s.
3	:	5	::	2753	10
					5

3)13767 10

£4589 3s. 4d. B's share

				£	s.
3	:	7	::	2753	10
					7

3)19274 10

£6424 16s. 8d. C's share

F

(8)...

£	s.	d.		£	s.		yds.	
2	4	4½	:	15	15	::	17¾	: _x_
20				20			4	
44				315			71	
12				12				
532				3780				
2				2				
1065				7560				

$$x = \frac{\overset{504}{\cancel{7560} \times \cancel{71}}}{\underset{\cancel{15}}{\cancel{1065}}} = 504 \text{ qrs.} = 126 \text{ yards}$$

(9)...

	£	s.	d.
	1	17	6
		5 × 5 × 7 = 175	
	9	7	6
			5
	46	17	6
			7
	328	2	6 value of sheep
23 gui. × 11 =	265	13	0 ,, ,, oxen
	£62	9	6

(10)...

ft.	in.
10	9
	12
129	0 in 10 seconds
6	
774	per minute
60	

3)46440 per hour

1760)15480(8 mi. 1400 yds.

14080

‾1400 yards

EXERCISE XLI.

(1)...
$$
\begin{array}{r}
8090606 \\
19003 \\
\hline
24271818 \\
7281545400 \\
8090606 \\
\end{array}
$$

$323051)153745785818(475918$
$$
\begin{array}{r}
1292204 \\
\hline
2452538 \\
2261357 \\
\hline
1911815 \\
1615255 \\
\hline
2965608 \\
2907459 \\
\hline
581491 \\
323051 \\
\hline
2584408 \\
2584408 \\
\hline
\end{array}
$$

(2)...

$\quad\quad\quad \pounds \quad s. \quad d.$

$239)1108 \quad 2 \quad 3\frac{1}{4}(\pounds 4 \; 12s. \; 8\frac{3}{4}d.$
$$
\begin{array}{r}
956 \\
\hline
152 \\
20 \\
\end{array}
$$
$239)3042(12s$
$$
\begin{array}{r}
2868 \\
\hline
174 \\
12 \\
\end{array}
$$
$239)2091(8d.$
$$
\begin{array}{r}
1912 \\
\hline
179 \\
4 \\
\end{array}
$$
$239)717(3 \; far.$
$$
\begin{array}{r}
717 \\
\hline
\end{array}
$$

(3)...
$\quad$ 3 wks. 19 hrs. 25 min. 15 sec. = 1884315 sec.

133 wks. 6 da. 19 hrs. 5 min. 45 sec. = 81025545 sec.

$\quad$ 81025545 ÷ 1884315 = 43 times

(4)...

ac.		ac.	ro.	po.		£	s.	d.		
1	:	253	1	36	::	1	13	4	:	x
4		4				20				
4		1013				33				
40		40				12				
160		40556				400				

$$ \begin{array}{c} 20278 \quad 5 \\ x = \frac{40556 \times 400}{160} = 101390d. = £422\ 9s.\ 2d. \\ 2 \end{array} $$

(5)...

£   s.   d.

   5 16 8

      $6 \times 7 + 1 = 43$

35	0	0
		7
245	0	0
5	16	8

2 qrs. =   2 18 4

1 qr. =   1 9 2

14 lb. =   0 14 7

7 lb. =   0   7 $3\frac{1}{2}$

£256   6 $0\frac{1}{2}$

(6)...2   7   6

£   s.   d.

     $4 \times 9 \times 10 + 5 = 365$

9	10	0
		9
85	10	0
		10
855	0	0
11	17	6
866	17	6

$4\frac{1}{2}$ gui. $\times 12 = 56$ 14 0

£923 11 6

$$ £1000 - £923\ 11s.\ 6d. = £76\ 8s.\ 6d. $$

(7)...

$$ 3 + 5 + 7 = 15 $$
$$ 180° \div 15 = 12° $$
$$ 12° \times 3 = 36° $$
$$ 12° \times 5 = 60° $$
$$ 12° \times 7 = 84° $$

(8)...

yds.		yds.		£	s.	d.		
$29\frac{7}{8}$	:	$37\frac{3}{8}$	::	12	13	$11\frac{1}{4}$	:	x
8		8		20				
239		299		253				
				12				
				3047				
				4				
	51			12189				

$$ x = \frac{299 \times 12189}{239} = 15249 \text{ far.} = £15\ 17s.\ 8\frac{1}{4}d. $$

(9)...

$$
\begin{array}{ccccccc}
£ & s. & & £ & & £ & s. & d. \\
8562 & 10 & : & 1 & :: & 749 & 4 & 4\tfrac{1}{2} & : & x \\
2 & & & 2 & & 20 & & \\
\hline
17125 & & & 2 & & 14984 & & \\
& & & & & 12 & & \\
& & & & & \hline \\
& & & & & 179812 & & \\
& & & & & 4 & & \\
& & & & & \hline \\
42 & & & & & 719250 & &
\end{array}
$$

$$ x = \frac{2 \times 719250}{17125} = 84 \text{ far.} = 1s.\ 9d. \text{ in the } £ $$

(10)...

126 gallons = 63 dozen

$$
\begin{array}{rr}
£ & s. \\
1 & 16 \\
 & 7 \times 9 = 63 \\
\hline
12 & 12 \\
 & 9 \\
\hline
\end{array}
$$

selling price = 113 8
90 gui. = 94 10
profit £18 18

EXERCISE XLII.

(1)...

1. $(476 + 359) \times (619 - 474)$
   $= 835 \times 145$
   $= 121075$

2. $(41857 - 14286) \div (215 + 134)$
   $= 27571 \div 349$
   $= 79$

$$
\begin{array}{cccc}
\text{mi.} & \text{fur.} & \text{po.} & \text{yds.} \\
19 & 5 & 27 & 4 \\
8 & & & \\
\hline
157 & & & \\
40 & & & \\
\hline
6307 & & & \\
5\tfrac{1}{2} & & & \\
\hline
31539 & & & \\
3153\tfrac{1}{2} & & & \\
\hline
34692\tfrac{1}{2} & & & \\
3 & & & \\
\hline
104077\tfrac{1}{2} \text{ feet} & & &
\end{array}
$$

(3)...
$$
\begin{array}{c}
\text{sq. ft.} \\
9)\overline{976349} \\
\overline{108483 \quad 2 \text{ sq. ft.}} \\
4
\end{array}
$$

$$
30\tfrac{1}{4}\times 4 = 121 \left\{ \begin{array}{l} 11)\overline{433932} \\ 11)\overline{39448} \quad 4 \\ \overline{40)3586 \quad 2} \end{array} \right\} 26 \text{ qrs.} = 6\tfrac{1}{2} \text{ yds.}
$$

$$
\begin{array}{l}
4)\;\overline{89} \quad 26 \text{ po.} \\
\overline{22 \quad 1 \text{ ro.}}
\end{array}
$$

Ans. 22 ac. 1 ro. 26 po. 6½ yds. 2 ft.
= 22 ac. 1 ro. 26 po. 6 yds. 6½ ft.

Proof.

ac. ro. po. yds. ft.
22 1 26 6 6½

$$
\begin{array}{r}
4 \\
\hline
89 \\
40 \\
\hline
3586 \\
30\tfrac{1}{4} \\
\hline
107586 \\
896\tfrac{1}{2} \\
\hline
108482\tfrac{1}{2} \\
9 \\
\hline
976349 \text{ sq. feet}
\end{array}
$$

(4)...

£3 17s. 3½d. = 3710 farthings
£305 6s. 0½d. = 293090 farthings

293090 ÷ 3710 = 79 times

(5)...

		s.	d.	£	s.	d.
10	Latin Grammars ...	3	6	= 1	15	0
8	Greek „ ...	4	0	= 1	12	0
6	Virgils	7	6	= 2	5	0
8	Latin Dictionaries...	5	6	= 2	4	0
4	Greek Lexicons ...	8	6	= 1	14	0
				£9	10	0

(6)... January, February and March (1868) contain, together,
91 days = 13 weeks

$$
\begin{array}{cc}
s. & d. \\
13 & 6 \\
13 & \\
\hline
£8 \quad 15 & 6
\end{array}
$$

(7)...

ac.	ro.	per.		ac.		£	s.	d.		
5	2	30	:	1	::	11	18	10½	:	x
4				4			.20			
22				4			238			
40				40			12			
910				160			2866			
							4			
							11466			

$$x = \frac{\overset{32}{\cancel{160}} \times \overset{63}{\cancel{11466}}}{\underset{5}{\cancel{910}}} = 2016 \text{ far.} = £2 \ 2s. \text{ per acre}$$

ac.	ro.	per.		ac.		£	s.	d.		
7	3	20	:	1	::	17	14	4½	:	x
4				4			20			
31				4			354			
40				40			12			
1260				160			4252			
							4			
							17010			

$$x = \frac{\overset{80}{\cancel{160}} \times \overset{27}{\cancel{17010}}}{\underset{2}{\cancel{1260}}} = 2160 \text{ far.} = £2 \ 5s. \text{ per acre}$$

(8)...

cwt.	qrs.	lb.		t.	cwt.	qr.	lb.		£	s.	d.		
1	2	15	:	3	14	1	9	::	6	17	3	:	x
4				20					20				
6				74					137				
28				4					12				
183				297					1647				
				28									
				8325									

$$x = \frac{8325 \times \overset{9}{\cancel{1647}}}{\cancel{183}} = 74925d. = £312 \ 3s. \ 9d.$$

(9)...
$$\begin{array}{ccccccc}
\text{in.} & & \text{in.} & & \text{yds.} & & \\
30\frac{1}{4} & : & 24\frac{3}{4} & :: & 60\frac{1}{2} & : & x \\
4 & & 4 & & 4 & & \\
\hline
121 & & 99 & & 242 & &
\end{array}$$

$$x = \frac{99 \times \overset{2}{\cancel{242}}}{\cancel{121}} = 198 \text{ qrs.} = 49\frac{1}{2} \text{ yards}$$

(10)...
$$\begin{array}{ccc}
\text{sq. yds.} & \text{sq. yds.} & \text{sq. yds.} \\
275 & + \quad 330 = 605 & = 20 \text{ perches}
\end{array}$$

$$\begin{array}{ccccccccc}
\text{per.} & & \text{ac.} & \text{ro.} & \text{per.} & & \text{hr.} & & \\
20 & : & 2 & 3 & 30 & :: & 1 & : & x \\
& & 4 & & & & & & \\
\hline
& & 11 & & & & & & \\
& & 40 & & & & & & \\
\hline
& & 470 & & & & & &
\end{array}$$

$$x = \frac{470}{20} = 23\frac{1}{2} \text{ hours}$$

EXERCISE XLIII.

(1)...
$$\begin{array}{r}
1019)18281879(17941 \\
1019 \\
\hline
8091 \\
7133 \\
\hline
9588 \\
9171 \\
\hline
4177 \\
4076 \\
\hline
1019 \\
1019 \\
\hline
\end{array}$$

(2)...
              wks. da. hrs. min.

19)145   2 14 55(7 wks. 4 da. 13 hrs. 25 min.
133
——
12
7
——
19)86(4 da.
76
——
10
24
——
19)254(13 hrs.
19
——
64
57
——
7
60
——
19)475(25 min.
38
——
95
95
——

(3)...

s.	d.		£	s.	d.		yd.		
12	8	:	16	15	8	::	1	:	x
12			20						
152			335						
			12						
			4028						

$$x = \frac{4028}{152} = \frac{53}{2} = 26\tfrac{1}{2} \text{ yards}$$

(4)...

              s. d.
              3   6 per bottle
                12
            ——
          42   0 per dozen
          45
         ——
        210

         d.   s. 168
36 gal. at 18 = 54)1890(35 barrels
           · 162
          ——
         270
         270
         ——

$$
\begin{array}{ccccccc}
 & \text{cu. ft.} & & \text{cu. ft.} & & \pounds & s. & d. \\
(5)\dots & 16750 & : & 1000 & :: & 3 & 15 & 4\frac{1}{2} & : & x
\end{array}
$$

$$
\begin{array}{r}
20 \\
\hline
75 \\
12 \\
\hline
904 \\
4 \\
\hline
3618
\end{array}
$$

$$
x = \frac{\overset{4}{\cancel{1000}} \times \overset{54}{\cancel{3618}}}{\underset{67}{\cancel{16750}}} = 216 \text{ far.} = 4s.\ 6d. \text{ per thousand cu. ft.}
$$

(6)... 4 cwt. 3 qrs. 21 lb. = 553 lb.

$$
\begin{array}{r}
6 \\
12)\overline{3318} \\
20)\overline{276\ \ 6}
\end{array}
$$

$$
\begin{array}{lrrr}
\text{selling price} & 13 & 16 & 6 \\
\text{cost price} & 12 & 1 & 11\frac{1}{4} \\
\hline
\text{profit} & \pounds 1 & 14 & 6\frac{3}{4}
\end{array}
$$

$$
\begin{array}{ccccccc}
 & \text{mi.} & & \text{mi.} & & \text{hrs.} & \text{min.} \\
(7)\dots & 22 & : & 18 & :: & 5 & 52 & : & x
\end{array}
$$

$$
\begin{array}{r}
60 \\
\hline
352
\end{array}
$$

$$
x = \frac{18 \times \overset{16}{\cancel{352}}}{\cancel{22}} = 288 \text{ min.} = 4 \text{ hrs. } 48 \text{ min.}
$$

(8)... $37\frac{3}{4}$ yds. $\times 6 = 226\frac{1}{2}$ yds.

$$
\begin{array}{ccccccc}
\text{yds.} & & \text{yds.} & & \pounds & s. & d. \\
43\frac{1}{2} & : & 226\frac{1}{2} & :: & 1 & 3 & 6\frac{3}{4} & : & x \\
2 & & 2 & & 20 & & \\
\hline
87 & & 453 & & 23 & & \\
 & & & & 12 & & \\
\hline
 & & & & 282 & & \\
 & & & & 4 & & \\
\hline
 & & & & 1131 & &
\end{array}
$$

$$
x = \frac{453 \times \overset{13}{\cancel{1131}}}{\cancel{87}} = 5889 \text{ far.} = \pounds 6\ 2s.\ 8\frac{1}{4}d
$$

(9)...   45 gal. + 7 gal. = 52 gal. = 26 dozen

$$\begin{array}{ccc} £ & s. & d. \end{array}$$

57s. 6d. = 2 17 6 per dozen

$$5 \times 5 + 1 = 26$$

$$\begin{array}{rrr} \overline{14} & 7 & 6 \\ & & 5 \\ \hline 71 & 17 & 6 \\ 2 & 17 & 6 \\ \hline 74 & 15 & 0 \text{ selling price} \end{array}$$

55 gui. = 57 15 0 cost price

£17 0 0 profit

(10)...   2 qrs. 24½ lb. × 313 = 25196½ lb.

$$\begin{array}{cccccccc} \text{lb.} & & \text{lb.} & & s. & d. & & \\ 112 & : & 25196\tfrac{1}{2} & :: & 65 & 4 & : & x \\ 2 & & 2 & & 12 & & & \\ \hline 224 & & 50393 & & 784 & & & \\ & & & & 7 & & & \end{array}$$

$$x = \frac{50393 \times 78\!\!\!/4}{2\!\!\!/2\!\!\!/4} = \frac{352751}{2} d. = £734 \ 17s. \ 11\tfrac{1}{2}d.$$

EXERCISE XLIV.

(1)...
$$\begin{array}{l} \text{oz.} \\ 16)4763289 \\ \hline 28)297705 \quad 9 \text{ oz.} \\ \hline 4)10632 \quad 9 \text{ lb.} \\ \hline 20)2658 \\ \hline 132 \quad 18 \text{ cwt} \end{array}$$

Ans. 132 tons 18 cwt. 9 lb. 9 oz.

(2)...
$$\begin{array}{l} \text{yds.} \\ 347 \\ 1s. \ 9\tfrac{1}{2}d. = \ 21\tfrac{1}{2}d. \\ \hline 347 \\ 694 \\ 173\tfrac{1}{2} \\ \hline 12)7460\tfrac{1}{2} \\ \hline 20)621 \quad 8\tfrac{1}{2} \\ \hline £31 \quad 1s. \ 8\tfrac{1}{2}d. \end{array}$$

(3)...
$$\begin{array}{ccc} s. & d. & d. \\ 3 & 9 & = 45 \\ & & 31 \\ \hline & & 45 \\ & & 135 \\ \hline & & 1395 \end{array}$$

$$\begin{array}{ccc} s. & d. & hf.\,d. \quad 2 \\ 3 & 10\tfrac{1}{2} & = 93)2790(30 \text{ yards} \\ & & 279 \\ \hline & & \ . \ . \ 0 \end{array}$$

(4)..   14¾ yds. Black Lutestring 3   8 = 2 14   1
       6½   „   French Merino ...3   9 = 1   4   4½
       15¼   „   Bombazine ......1 10 = 1   8   5
       6¾   „   Crape..............2   9 = 0 18   6¾

$$£ \quad s. \quad d. \quad £6 \quad 5 \quad 5¼$$

(5)...   cost price 12   0   9
      required profit   2 12   6
      selling price 14 13   3

lb.		lb.		£	s.	d.	
76½	:	1	::	14	13	3	. x
2		2		20			
153		2		293			
				12			
				3519			

$$x = \frac{2 \times \overset{23}{\cancel{3519}}}{\cancel{153}} = 46d. = 3s.\ 10d. \text{ per lb.}$$

(6)...   cwt. qrs. lb.
            2   1   16
            1   2   24
difference in weight   2   20

qrs.	lb.		lb.		s.	d.		
2	20	:	112	::	2	4½	..	x
28					12			
76					28			
					4			
					114			

$$x = \frac{\overset{56}{\cancel{112}} \times \overset{3}{\cancel{114}}}{\underset{2}{\cancel{76}}} = 168 \text{ far.} = 3s.\ 6d.$$

(7)...   min.   min.   hrs. min.
        64   :   156   ::   4   30   : x
                       60
                     270

$$x = \frac{\overset{39}{\cancel{156}} \times \overset{135}{\cancel{270}}}{\underset{\underset{8}{\cancel{16}}}{\cancel{64}}} = \frac{5265}{8} \text{ min.} = 10 \text{ hrs. } 58⅛ \text{ min.}$$

(8)...

ac.	ro.	per.		ac.	ro.	per.		t.	cwt.		
4	1	20	:	5	3	10	::	12	5	:	x
4				4				20			
$\overline{17}$				$\overline{23}$				$\overline{245}$			
40				40							
$\overline{700}$				$\overline{930}$							

$$x = \frac{\overset{93}{\cancel{930}} \times \overset{7}{\cancel{245}}}{\underset{\underset{2}{\cancel{20}}}{\cancel{700}}} = \frac{651}{2} \text{ cwt.} = 16 \text{ tons } 5\tfrac{1}{2} \text{ cwt.}$$

(9)...

From March 5 to Dec. 22 = 292 days

da.		da.		£	s.		
365	:	292	::	11	15	:	x
				20			
				$\overline{235}$			

$$x = \frac{\overset{4}{\cancel{292}} \times \overset{47}{\cancel{235}}}{\underset{\underset{5}{\cancel{365}}}{\cancel{365}}} = 188s. = £9 \ 8s.$$

(10)...

20s. + 25s. + 30s. = 75 shillings

s.		s.		£		
75	:	20	::	135	:	x

$$x = \frac{\overset{4}{\cancel{20}} \times \overset{9}{\cancel{135}}}{\underset{\underset{15}{\cancel{75}}}{\cancel{75}}} = £36, \text{ A's share}$$

s.		s.		£		
75	:	25	::	135	:	x

$$x = \frac{\overset{45}{\cancel{25} \times \cancel{135}}}{\underset{\underset{3}{\cancel{75}}}{\cancel{75}}} = £45, \text{ B's share}$$

$$\overset{s.}{75} \; : \; \overset{s.}{30} \; :: \; \overset{£}{135} \; : \; x$$

$$x = \frac{\overset{2}{\cancel{30}} \times \overset{27}{\cancel{135}}}{\underset{\cancel{5}}{\cancel{75}}} = £54, \text{ C's share}$$

EXERCISE XLV.

(1)...
E.	ells	qrs.	na.	in.
	27	4	3	$1\frac{1}{4}$

$$\begin{array}{r} 5 \\ \hline 139 \\ 4 \\ \hline 559 \\ 2\frac{1}{4} \\ \hline 1119\frac{1}{4} \\ 139\frac{3}{4} \\ \hline 1259 \text{ inches} \end{array}$$

(2)...From Easter Day to Whitsunday

$$= 50 \text{ days}$$
$$\begin{array}{r} 24 \\ \hline 1200 \\ 60 \\ \hline 72000 \text{ minutes} \end{array}$$

(3)...
	qrs.	bu.	pks.	gal.
	19	5	2	1

$$\begin{array}{r} 8 \\ \hline 157 \\ 4 \\ \hline 630 \\ 2 \\ \hline 1261 \\ 4 \\ \hline 5044 \text{ quarts} \end{array}$$

(4)...
		£	s.	d.
37 hf. gui.	=	19	8	6
119 hf. cr.	=	14	17	6
		£4	11	0

(5)...
	£	s.	d.
	103	8	$2\frac{3}{4}$
			4

$13\frac{3}{4} \times 4 = 55 \begin{cases} 5)413 \ 12 \ 11 \\ 11)82 \ 14 \ 7 \end{cases}$

$$£7 \; 10 \; 5$$

(6)...
$176 \begin{cases} 2)1 \ 5 \ 8 \\ 8)\overline{12 \ 10} \\ 11)\overline{1 \ 7\frac{1}{4}} \end{cases}$

	£	s.	d.

$1\frac{3}{4}d.$ per mile

$$(7)\ldots \quad \begin{array}{llll} & & d. & \pounds \quad s. \quad d. \\ 45 \text{ yds. Dimity} & 9\frac{1}{2} & = 1 \quad 15 \quad 7\frac{1}{2} \\ 27 \text{ ,,} \quad \text{Calico} & 4\frac{3}{4} & = 0 \quad 10 \quad 8\frac{1}{4} \\ 56 \text{ ,,} \quad \text{Chintz} & 7\frac{1}{2} & = 1 \quad 15 \quad 0 \\ 56 \text{ ,,} \quad \text{Lining} & 5 & = 1 \quad 3 \quad 4 \\ 27 \text{ ,,} \quad \text{Fringe} & 10 & = 1 \quad 2 \quad 6 \\ \hline & & \pounds 6 \quad 7 \quad 1\frac{3}{4} \end{array}$$

$(8)\ldots \quad 6$ cwt. 1 qr. $10\frac{1}{2}$ lb. $\times 7 = 44$ cwt. 1 qr. $17\frac{1}{2}$ lb.

cwt.	qrs.	lb.		cwt.	qr.	lb.		£	s.	d.		
5	2	24½	:	44	1	17½	::	12	0	2¼	:	x
4				4				20				
22				177				240				
28				28				12				
200				1433				2882				
44				354				4				
640				4973				11529				
2				2								
1281				9947								

$$x = \frac{9947 \times \overset{9}{\cancel{11529}}}{\cancel{1281}} = 89523 \text{ far.} = \pounds 93 \text{ } 5s. \text{ } 0\frac{3}{4}d.$$

$(9)\ldots$ Dividends, $5 \overset{s.\ d.}{7\frac{1}{2}} + 3 \overset{s.\ d.}{2\frac{1}{2}} + 2 \overset{s.\ d.}{4\frac{1}{2}} = 11 \text{ } 2\frac{1}{2}$ in the $\pounds$

Loss, $20s. - 11s. \text{ } 2\frac{1}{2}d. = 8s. \text{ } 9\frac{1}{2}d.$ in the $\pounds$

$$\begin{array}{ccccccc} \pounds & & \pounds & & s. & d. & \\ 1 & : & 575 & :: & 8 & 9\frac{1}{2} & : \quad x \\ & & & & 12 & & \\ \cline{5-6} & & & & 105 & & \\ & & & & 4 & & \\ \cline{5-6} & & & & 422 & & \end{array}$$

$x = 575 \times 422 = 242650$ far. $= \pounds 252 \text{ } 15s. \text{ } 2\frac{1}{2}d.$

$$(10)\ldots \quad \begin{array}{l} 85 \text{ sq. yds.} \times 4 = 340 \text{ sq. yds.} \\ 53 \text{ ,,} \quad \times 5 = \underline{265 \text{ ,,}} \\ \qquad\qquad\qquad\quad 605 \text{ ,,} \end{array}$$

$4\frac{1}{2}$ acres $= 21780$ sq. yards

$21780 \div 605 = 36$ hours

EXERCISE XLVI.

<div>

	£	s.	d.
(1)...7 ten-pound notes	=70	0	0
49 sovereigns	=49	0	0
23 half sov.	=11	10	0
55 half cr.	= 6	17	6
113 sixpences	= 2	16	6
	140	4	0
	20		
	2804		
	3		
	8412 fourp.		

	ac.	ro.	per.
(2)...	23	2	29
	4		
	94		
	40		
	3789		
	$30\frac{1}{4}$		
	113670		
	$947\frac{1}{4}$		
	$114617\frac{1}{4}$ sq. yds.		

</div>

	cwt.	qrs.	lb.	oz.
(3)...	7	2	17	9
	9	1	24	11
	13	3	9	6
	17	3	7	12
	48	3	3	6 = 87414 ounces

2 cwt. 3 qrs. 13 lb. 6 oz. = 5142 ounces

$87414 \div 5142 = 17$

(4)...   3 bu. 2 pks. = 14 pecks
21 qrs. 3 bu. 2 pks. = 686 pecks

$686 \div 14 = 49$ sacks

	ac.	ro.	sq. yds.
(5)...	3	2	25
	4		
	14		
	40		
	560		
	$30\frac{1}{4}$		
	16825		
	140		

145)16965(117 yards
145
246
145
1015
1015

(6)...

$$\begin{array}{cc} s. & d. \\ 2 & 3\frac{1}{2} \\ 12 & \\ \overline{27} & \\ 2 & \\ \overline{55} & \end{array} \quad : \quad \begin{array}{c} \pounds \\ 626 \\ 20 \\ \overline{12521} \\ 12 \\ \overline{150254} \\ 2 \\ \overline{300509} \end{array} \quad :: \quad \begin{array}{cc} s. & d. \\ 1 & 2\frac{1}{2} \end{array} \quad \begin{array}{c} \pounds \\ 1 \end{array} \quad : \quad x$$

$$x = \frac{300509}{55} = \pounds 5463\frac{4}{5} = \pounds 5463 \ 16s.$$

(7)...

$$\text{Perimeter of ground} = \begin{array}{cccc} ft. & in. & ft. & in. \\ (49 & 6 + 38 & 3) \times 2 \end{array}$$
$$= 175 \text{ ft. } 6 \text{ in.}$$
$$= 2106 \text{ inches}$$

$$2106 \div 13\frac{1}{2} = 156 \text{ boards}$$

(8)...

$$\begin{array}{cccc} \pounds & s. & d. & d. & d. \\ 100 \div 6 & 3 & = 2400 \div 75 & = 320, \text{ number of days} \end{array}$$

The savings will have amounted to £100 on November 15.

(9)...

$$\begin{array}{cc} E. \ ells & qrs. \\ 19 & 3 \\ 5 & \\ \overline{98} & \end{array} \quad : \quad \begin{array}{cc} yds. & qr. \\ 47 & 1 \\ 4 & \\ \overline{189} & \end{array} \quad :: \quad \begin{array}{ccc} \pounds & s. & d. \\ 3 & 13 & 6 \\ 20 & & \\ \overline{73} & & \\ 12 & & \\ \overline{882} & & \end{array} \quad : \quad x$$

$$x = \frac{189 \times \overset{9}{\cancel{882}}}{\cancel{98}} = 1701d. = \pounds 7 \ 1s. \ 9d.$$

(10)...

$$\begin{array}{ccc} \pounds & s. & d. \\ 3 & 10 & 0 \\ & 13 & \\ \overline{45} & 10 & 0 \\ 2 \text{ qrs.} = 1 & 15 & 0 \\ 1 \text{ qr.} = 0 & 17 & 6 \\ \overline{\pounds 48} & 2 & 6 \end{array} \qquad \begin{array}{ccc} \pounds & s. & d. \\ 4 & 4 & 0 \\ & & 11 \\ \overline{46} & 4 & 0 \\ 2 \text{ qrs.} = 2 & 2 & 0 \\ \overline{\pounds 48} & 6 & 0 \end{array}$$

$$\begin{array}{cccc} & \pounds & s. & d. \\ \text{B's debt to A} = & 48 & 6 & 0 \\ \text{A's debt to B} = & 48 & 2 & 6 \\ \therefore \text{ B owes A} & & 3 & 6 \end{array}$$

G

EXERCISE XLVII.

(1)...
```
        834
        679
       7506
       5838
       5004
 97)566286(5838
    485
    ‾812
    776
    ‾368
    291
    ‾776
     776
```

(2)...

£	s.	d.
37	16	$4\frac{3}{4} \times 5$
		10
378	3	$11\frac{1}{2} \times 3$
		10
3781	19	7
		6
22691	17	6
1134	11	$10\frac{1}{2}$
189	1	$11\frac{3}{4}$
£24015	11	$4\frac{1}{4}$

(3)...

		da.
From Feb. 9, 1867, to Feb. 9, 1868	=	365
remainder of Feb. ,,	=	20
March ,,	=	31
April ,,	=	30·
May ,,	=	31
June ,,	=	30
to July 7 ,,	=	7
		514 days

(4)...

	£	s.	d.
	86	12	6
	78	17	6
profit on each share	7	15	0
		$5 \times 5 = 25$	
	38	15	0
		5	
profit on 25 shares	£193	15	0

$$
\begin{array}{c}
\text{£} \quad \text{s.} \quad \text{d.} \\
\end{array}
$$

(5)...

	£	s.	d.
	2	6	0
			5
	11	10	0
1 rood =	0	11	6
20 perches =	0	5	9
10 „ =	0	2	10½
rent of field =	12	10	1½
50 bushels at 3s. 6d. =	8	15	0
balance due = £3	15	1½	

(6)...

		s.	d.	£	s.	d.
39 yds. Brussels Carpeting...		4	11 =	9	11	9
27 „ Scotch „ ...		2	8 =	3	12	0
7½ „ Drugget		2	9 =	1	0	7½
6 „ Matting		2	3 =	0	13	6
6½ „ Oil-cloth		2	6 =	0	16	3
2 Hearth-rugs		23	6 =	2	7	0
			£18	1	1½	

(7)...

$$4 \text{ cwt. } 2 \text{ qrs. } 14 \text{ lb.} = 518 \text{ lb.}$$

$$5d.$$

$$12)\overline{2590}$$

$$20)\overline{215} \quad 10$$

selling price	10	15	10
cost price	9	14	3
profit = £1	1	7	

(8)...

Dividends 6 $3\frac{1}{2}$ + 3 $4\frac{1}{2}$ + 2 $2\frac{1}{2}$ = 11 $10\frac{1}{2}$ in the £

Loss 20s. — 11s. $10\frac{1}{2}d.$ = 8s. $1\frac{1}{2}d.$ in the £

$$
\begin{array}{ccccccc}
\text{£} & & \text{£} & & \text{s.} & \text{d.} & \\
1 & : & 5745 & :: & 8 & 1\frac{1}{2} & : \quad x \\
& & & & 12 & & \\
& & & & \overline{97} & & \\
& & & & 4 & & \\
& & & & \overline{390} & &
\end{array}
$$

$$x = 5745 \times 390 = 2240550 \text{ far.} = £2333 \ 18s. \ 1\frac{1}{2}d.$$

(9)...
$$\overset{\text{yds.}}{} \quad \overset{\text{yds.}}{} \quad \overset{\text{sq. yds.}}{} \quad \overset{\text{sq. ft.}}{}$$
Area of field $= (245 \times 165) = 40425 = 363825$

Area of each garden $= 55 \text{ ft.} \times 35 \text{ ft.} = 1925 \text{ sq. ft.}$

```
1925)363825(189 gardens
     1925
     ‾‾‾‾‾
     17132
     15400
     ‾‾‾‾‾
     17325
     17325
     ‾‾‾‾‾
```

(10)... By express train $180 \div 40 = 4$ hours 30 minutes
By ordinary train $180 \div 25 = 7$ hours 12 minutes

```
              hrs.  min.
               7    12
               4    30
              ‾‾‾‾‾‾‾‾‾‾
time saved =   2    42
              ‾‾‾‾‾‾‾‾‾‾
```

EXERCISE XLVIII.

(1)...
```
          784
          25¾
        ‾‾‾‾‾
        3920
        1568
         392
         196
        ‾‾‾‾‾
       20188
```

```
                16827
                    4
                ‾‾‾‾‾‾‾
19¾ × 4 =   79)67308(852
                632
                ‾‾‾‾
                 410
                 395
                ‾‾‾‾
                 158
                 158
                ‾‾‾‾
```

$$\begin{array}{ccc} \pounds & s. & d. \\ 138 & 4 & 4\tfrac{3}{4} \\ & & 2 \end{array}$$

$29\tfrac{1}{2} \times 2 = 59\overline{)276\quad 8\quad 9\tfrac{1}{2}}(\pounds4\ 13s.\ 8\tfrac{1}{2}d.$

$$\begin{array}{l} 236 \\ \hline 40 \\ 20 \end{array}$$

$59\overline{)808}(13s.$

$$\begin{array}{l} 59 \\ \hline 218 \\ 177 \\ \hline 41 \\ 12 \end{array}$$

$59\overline{)501}(8d.$

$$\begin{array}{l} 472 \\ \hline 29 \\ 4 \end{array}$$

$59\overline{)118}(2\ far.$

$$118$$

(3)...
$$\begin{array}{r} \text{in.} \\ 12\overline{)1676412} \\ \hline 3\overline{)139701} \\ \hline 220\overline{)46567} \\ \hline 8\overline{)211}\quad 147\ \text{yds.} \\ \hline 26\quad 3\ \text{fur.} \end{array}$$

Ans. 26 mi. 3 fur. 147 yds.

(4)...
$$\begin{array}{r} 1\ \text{mile} = 1760\ \text{yards} \\ 35 \\ \hline 8800 \\ 5280 \\ \hline 61600 \\ 3 \end{array}$$

$1\ \text{hr.} = 3600\overline{)184800}(51\tfrac{1}{3}\ \text{ft.}$

$$\begin{array}{r} \text{sec.}\\ 18000 \\ \hline 4800 \\ 3600 \\ \hline 1200 \\ 3600 \end{array} = \tfrac{1}{3}$$

$$
\begin{array}{ccccccc}
 & \text{ac.} & & \text{ac.} & \text{ro.} & \text{per.} & & \pounds & s. \\
(5)\ldots & 1 & : & 753 & 2 & 15 & :: & 52 & 10 & : & x \\
 & 4 & & 4 & & & & & 20 \\
\hline
 & 4 & & 3014 & & & & & 1050 \\
 & 40 & & 40 \\
\hline
 & 160 & & 120575
\end{array}
$$

$$
x = \frac{120575 \times \overset{105}{\cancel{1050}}}{\underset{16}{\cancel{160}}} = \frac{12660375}{16}s. = \pounds 39563\ 13s.\ 5\tfrac{1}{4}d.
$$

$$
\begin{array}{ccccccccc}
 & \text{oz.} & \text{dwt.} & \text{grs.} & & \text{oz.} & \text{dwt.} & \text{grs.} & & \pounds & s. & d. \\
(6)\ldots & 3 & 13 & 12 & : & 17 & 9 & 12 & :: & 14 & 4 & 9\tfrac{3}{4} & : & x \\
 & 20 & & & & 20 & & & & 20 \\
\hline
 & 73 & & & & 349 & & & & 284 \\
 & 24 & & & & 24 & & & & 12 \\
\hline
 & 304 & & & & 1408 & & & & 3417 \\
 & 146 & & & & 698 & & & & 4 \\
\hline
 & 1764 & & & & 8388 & & & & 13671
\end{array}
$$

$$
x = \frac{\overset{233}{\cancel{8388}} \times \overset{279}{\cancel{13671}}}{\underset{49}{\underset{1764}{\cancel{1764}}}} = 65007\ \text{far.} = \pounds 67\ 14s.\ 3\tfrac{3}{4}d.
$$

(7)...   3 cwt. 2 qrs. 8 lb. = 400 lb.

400 lb. at $6\tfrac{1}{2}d.$ per lb. = $\pounds 10$ 16s. 8d.

$$
\begin{array}{cccccccccc}
\pounds & s. & d. & & \pounds & s. & d. & & \text{lb.} \\
2 & 6 & 8 & : & 10 & 16 & 8 & :: & 112 & : & x \\
20 & & & & 20 \\
\hline
46 & & & & 216 \\
12 & & & & 12 \\
\hline
560 & & & & 2600
\end{array}
$$

$$
x = \frac{\overset{520}{\cancel{2600}} \times \cancel{112}}{\underset{5}{\underset{560}{\cancel{560}}}} = 520\ \text{lb.} = 4\ \text{cwt.}\ 2\ \text{qrs.}\ 16\ \text{lb.}
$$

$$
\begin{array}{ccccccc}
 & d. & & d. & & \pounds & s. & d. \\
(8)\ldots & 10 & : & 7 & :: & 17 & 14 & 7 \\
 & & & & & & & 7 \\
\hline
 & & & & 10)124 & 2 & 1 \\
\hline
 & & & & \pounds 12 & 8 & 2\tfrac{1}{2}
\end{array}
$$

(9)...
$$12 \text{ cwt.} \times 240 = 2880 \text{ cwt.} = 144 \text{ tons}$$
$$8 \text{ cwt.} \times 40 = 320 \text{ cwt.} = \underline{16 \text{ tons}}$$
$$\overline{160 \text{ tons}}$$

	£	s.	d.
10)100	0	0

$$160 \left\{ \begin{array}{ccc} 10)100 & 0 & 0 \\ \hline 4)10 & 0 & 0 \\ \hline 4)2 & 10 & 0 \\ \hline 12 & 6 & \text{per ton} \end{array} \right.$$

(10)... From noon, March 10 to 8 P.M. March 16=6⅓ days

$$\begin{array}{rcl} & & \text{min. sec.} \\ \text{Time gained in 1 day} & = & 2 \quad 30 \\ & & \underline{6\frac{1}{3}} \\ & & \overline{15 \quad 0} \\ & & 50 \\ \text{Time gained in } 6\frac{1}{3} \text{ days} & = & \overline{15 \quad 50} \end{array}$$

∴ the clock, at the latter date, will show 15 min. 50 sec. past 8.

EXERCISE XLIX.

(1)...
$$(479)^2 = 479 \times 479 = 229441$$
$$(83)^3 = 83 \times 83 \times 83 = 571787$$

(2)...

oz. dwt. grs.

11	13	17
15	14	19
17	9	13
44	18	1

$$\begin{array}{r} 44 \quad 18 \quad 1 \\ \underline{20} \\ \overline{898} \\ \underline{24} \\ \overline{3593} \\ 1796 \\ \overline{21553} \text{ grains} \end{array}$$

(3)...
$$125)1500000$$
$$\overline{60)12000} \text{ minutes}$$
$$\overline{200} \text{ hours}$$
$$2$$
$$11\frac{1}{2} \times 2 = 23)\overline{400}(17 \text{ days}$$
$$\underline{23}$$
$$\overline{170}$$
$$\underline{161}$$
$$\overline{9} \text{ hf. hrs.} = 4\frac{1}{2} \text{ hrs.}$$

Ans. 17 days 4½ hours

(4)...   5 cwt. 25 lb. = 9360 ounces
                7 lb. 6 oz. = 120 ounces
                9360÷120 = 78 boxes

(5)...

cwt.	qr.	lb.		cwt.	qrs.	lb.			mi.		
2	1	27	:	3	2	11	::		45	:	x
4				4							
9				14							
28				28							
279				403							

$$x = \frac{\overset{13}{\cancel{403}} \times \overset{5}{\cancel{45}}}{\underset{9}{\cancel{279}}} = 65 \text{ miles}$$

(6)...

$$35 \left\{ \begin{array}{c} \text{ac.} \quad \text{ro.} \quad \text{per.} \\ 5)\overline{11 \quad 2 \quad 0} \\ 7)\overline{2 \quad 1 \quad 8} \end{array} \right.$$

1 ro. 12 per. 17$\frac{2}{7}$ yds.

(7)...30 inches × 108 = 3240 inches = 90 yards per minute

7 miles = 12320 yards

90)12320

60)136$\frac{8}{9}$ min.

2 hrs. 16$\frac{8}{9}$ min.

(8)...

	£	s.	d.
	36	1	6
	20		
	721		
d.	12		

9s. 9d. = 117)8658(74 gallons

819
───
468
468
───

74 gallons of rum *and* water
63 gallons of rum
───
11 gallons of water

(9)... $\qquad$ 16 cwt. 2 qrs. 24 lb. = 1872 lb.

$$\begin{array}{ccccccc} \text{lb. Av.} & & \text{lb. Av.} & & \text{lb. Tr.} & & \\ 144 & : & 1872 & :: & 175 & : & x \end{array}$$

$$x = \frac{\overset{13}{\cancel{1872}} \times 175}{\cancel{144}} = 2275 \text{ lb. Troy}$$

(10)...

		£	s.	d.
57293 penny stamps	=	238	14	5
2347 twopenny ,,	=	19	11	2
564 fourpenny ,,	=	9	8	0
373 sixpenny ,,	=	9	6	6
253 ninepenny ,,	=	9	9	9
		£286	9	10

EXERCISE L.

(1)...

		£	s.	d.
1 half sovereign	= 0	10	0
4 half crowns	= 0	10	0
5 florins	= 0	10	0
69 shillings	= 3	9	0
67 sixpences	= 1	13	6
9 fourpenny pieces	= 0	3	0
26 threepenny pieces	= 0	6	6
89 pennies	= 0	7	5
93 halfpennies	= 0	3	$10\frac{1}{2}$
18 farthings	= 0	0	$4\frac{1}{2}$
1 Australian penny	= 0	0	1
1 Belgian halfpenny	= 0	0	$0\frac{1}{2}$
383 coins	£7	13	$9\frac{1}{2}$

$$\begin{array}{ccc} \text{ac.} & \text{ro.} & \text{po.} \\ (2)\dots 9 & 0 & 35 \\ \underline{4} & & \\ 36 & & \\ \underline{40} & & \\ \overline{1475} & & \\ \underline{30\frac{1}{4}} & & \\ \overline{44250} & & \\ \underline{368\frac{3}{4}} & & \\ \overline{44618\frac{3}{4}} & & \\ \underline{9} & & \\ \overline{401568\frac{3}{4}} \text{ sq. feet} \end{array}$$

$$30\frac{1}{4} \times 4 = 121 \left\{ \begin{array}{l} 11)\overline{178475} \\ 11)\overline{16225} \end{array} \right.$$

Proof.

$$\begin{array}{l} 9)401568\frac{3}{4} \text{ sq. feet} \\ \overline{44618\frac{3}{4}} \\ 4 \\ \hline \\ 40)\overline{1475} \\ \hline 4)\overline{36} \quad 35 \text{ po.} \\ \hline 9 \text{ ac. 35 po.} \end{array}$$

(3)...
$$1 \text{ yd. } 3 \text{ qrs. } 2 \text{ nails} = 30 \text{ nails}$$
$$55 \text{ E. ells } 2 \text{ qrs. } 2 \text{ nails} = 1110 \text{ nails}$$

$$1110 \div 30 = 37 \text{ lengths}$$

(4)... 20s. $- 7d$. $= 19s$. $5d$. remaining from each pound

$s.$	$d.$		$£$	$s.$	$d.$		$£$	
19	5	:	713	11	3	::	1 :	x
12				20				
233			14271					
			12					
			171255					

$$x = \frac{171255}{233} = £735, \text{ gross income}$$

(5)...
$$66 \text{ shillings} = 198 \text{ fourpenny pieces}$$
$$1 \text{ lb. silver} = 12 \text{ ounces}$$
$$20$$
$$240$$
$$24$$
$$960$$
$$480$$

$$198 \begin{cases} 2)\overline{5760} \text{ grains} \\ 9)\overline{2880} \\ 11)\overline{320} \end{cases}$$

$$29\tfrac{1}{11} \text{ grs.} = 1 \text{ dwt. } 9\tfrac{1}{11} \text{ grs.}$$

(6)...

	$s.$	$d.$		$£$	$s.$	$d.$
3 gross exercise books	47	6	=	7	2	6
15 doz. copy books......	4	9	=	3	11	3
3 „ account books...	23	6	=	3	10	6
3 reams foolscap paper	14	6	=	2	3	6
10 gross steel pens......	2	9	=	1	7	6
4 doz. framed slates...	5	6	=	1	2	0
				£18	17	3

(7)...

£	s.	d.		£	s.	d.		yds.		
18	11	10½	:	21	8	1½	::	29¾	:	x

$$18\ 11\ 10\tfrac{1}{2}$$
20
371
12
4462
2
8925

$$21\ 8\ 1\tfrac{1}{2}$$
20
428
12
5137
2
10275

$$29\tfrac{3}{4}$$
4
119

$$x = \frac{\cancel{10275} \times \cancel{119}}{\cancel{8925}} = 137 \text{ qrs.} = 34\tfrac{1}{4} \text{ yards}$$

(8)...

		s.	d.		£	s.	d.
85¼ lb. tea		2	10	=	12	1	6¼
78½ „ „		3	3	=	12	15	1½
163¾					£24	16	8

	s.	d.		£	s.	d.
163¾ lb. tea	3	4	=	27	5	10
cost price			=	24	16	8
profit				£2	9	2

(9)...

		s.	d.			£	s.	d.
21 men		2	9	per day each	=	2	17	9
12 women	1	8		„ „	=	1	0	0
27 boys	1	2		„ „	=	1	11	6
						5	9	3 per day
								6
						£32	15	6 per week

		£	s.	d.
(10)...14 lb. butter at 13d. per lb............. =		0	15	2
40 eggs at 9d. per dozen .... =		0	2	6
4 couples fowls at 3s. 3d. per couple =		0	13	0
receipts =	£1	10	8

		s.	d.		£	s.	d.
8½ lb. beef	at 0	7	per lb. =	0	4	11½
½ „ tea	„ 3	10	„ =	0	1	11
3 „ sugar	„ 0	5½	„ =	0	1	4½
9½ yds. print	„ 0	9	per yd. =	0	7	1½
7 „ calico	„ 0	8	„ =	0	4	8
1 pair boots			=	0	8	6
expenditure =	£1	8	6½

	£	s.	d.
	1	10	8
	1	8	6½
money taken home =		2	1½

EXERCISE LI.

(1)...A *Prime Number* is a number that is divisible only by itself and by unity.

The *Greatest Common Measure* of two or more given numbers, is the greatest number that will divide each of the given numbers exactly.

The *Least Common Multiple* of two or more given numbers, is the least number that is divisible by each of the given numbers without a remainder.

(1)   23 29 31 37 41 43 47 53 59 61 67 71 73 79

(2)   1073)1421(1
         1073
         348)1073(3
           1044   G. C. M. = 29
           29)348(12
            29
            58
            58

$$(3) \quad 2)\overline{4 \quad 5 \quad 6 \quad 7 \quad 8}$$
$$2)\overline{2 \quad 5 \quad 3 \quad 7 \quad 4}$$
$$\overline{1 \quad 5 \quad 3 \quad 7 \quad 2}$$

L.C.M. $= 2 \times 2 \times 5 \times 3 \times 7 \times 2 = 840$

(2)... *Proper Fractions :* $\frac{7}{9}$, $\frac{11}{15}$, $\frac{23}{29}$

Improper Fractions : $\frac{8}{5}$, $\frac{11}{7}$, $\frac{19}{13}$

Mixed Numbers : $3\frac{5}{7}$, $4\frac{2}{9}$, $17\frac{7}{11}$

Compound Fractions : $\frac{1}{3}$ of $\frac{3}{5}$, $\frac{4}{7}$ of $\frac{5}{8}$ of $\frac{9}{11}$

Complex Fractions : $\frac{\frac{3}{4}}{\frac{5}{7}}$, $\frac{3\frac{1}{4}}{5}$, $\frac{5}{7\frac{3}{4}}$, $\frac{3\frac{1}{6}}{7\frac{3}{8}}$

(3)...
$$\frac{221}{272} \div \frac{17}{17} = \frac{13}{16}; \quad \frac{285}{361} \div \frac{19}{19} = \frac{15}{19};$$

$$\frac{713}{989} \div \frac{23}{23} = \frac{31}{43}.$$

(4)...
$$17\tfrac{25}{36} = \frac{(17 \times 36) + 25}{36} = \frac{637}{36};$$

$$29\tfrac{19}{47} = \frac{(29 \times 47) + 19}{47} = \frac{1382}{47};$$

$$47\tfrac{73}{85} = \frac{(47 \times 85) + 73}{85} = \frac{4068}{85}.$$

(5)... $\frac{547}{23} = 23\tfrac{18}{23};$ $\frac{1087}{59} = 18\tfrac{25}{59};$ $\frac{2377}{94} = 25\tfrac{27}{94}$

(6)...2s. 6d. $= \frac{1}{8}$ of £1

3d. $= \frac{1}{10}$ of 2s. 6d.

$\frac{3}{4}$d. $= \frac{1}{4}$ of 3d.

£	s.	d.	
7597	0	0	= value at £1 each
949	12	6	
94	19	3	
23	14	$9\frac{3}{4}$	
£1068	6	$6\frac{3}{4}$	

(7)...
1s. $= \frac{1}{20}$ of £1

6d. $= \frac{1}{2}$ of 1s.

$1\frac{1}{2}$d. $= \frac{1}{4}$ of 6d.

£	s.	d.
42637	0	0
2131	17	0
1065	18	6
266	9	$7\frac{1}{2}$
£3464	5	$1\frac{1}{2}$

(8)...

$$
\begin{array}{lrrr}
& & \pounds & s. & d. \\
\text{Value of stock} & = & 1786 & 17 & 11 \\
\text{Value of furniture} & = & 325 & 0 & 0 \\
\text{Total value of effects} & = & 2111 & 17 & 11 \\
\end{array}
$$

$$
\begin{array}{ccc}
\pounds \quad s. & \pounds & \pounds \quad s. \quad d. \\
3782 \;\; 10 \;\; : & 1 \;\; :: & 2111 \;\; 17 \;\; 11 \;\; : \quad x \\
2 & 2 & 20 \\
\hline
7565 & 2 & 42237 \\
& & 12 \\
& & \hline
& & 506855 \\
\end{array}
$$

$$
x = \frac{2 \times \overset{67}{\cancel{506855}}}{\cancel{7565}} = 134d. = 11s. \; 2d. \text{ in the } \pounds
$$

(9)...

$$
\begin{array}{lrrrr}
& & \pounds & s. & d. \\
108 \text{ gallons at } 3\tfrac{1}{2}d. \text{ per quart} & = & 6 & 6 & 0 \\
\text{profit} & = & 1 & 8 & 6 \\
\text{cost} & & \pounds 4 & 17 & 6 \\
\end{array}
$$

(10)...

$$13+17+23+29 = 82$$

$$3526 \div 82 = 43$$

$$
\left.
\begin{array}{l}
43 \times 13 = \;\; 559 \\
43 \times 17 = \;\; 731 \\
43 \times 23 = \;\; 989 \\
43 \times 29 = 1247 \\
\end{array}
\right\} Answers
$$

EXERCISE LII.

	c. yds.	c. ft.	c. in.
(1)...	43	0	573
	27		

$$
\begin{array}{r}
301 \\
86 \\
\hline
1161 \\
1728 \\
\hline
9861 \\
2322 \\
8127 \\
1161 \\
\hline
2006781 \text{ cu. inches} \\
\end{array}
$$

(2)...

$$
\begin{array}{r}
56040 \text{ fourpenny pieces} \\
4 \\
\hline
30\,)\overline{224160} \\
\hline
7472 \text{ half crowns} \\
\end{array}
$$

(3)...

ac.	ro.	per.	yds.
59	2	25	23

$$3 \times 9 = 27$$

$$
\begin{array}{rrrr}
178 & 3 & 37 & 8\tfrac{1}{2} \\
& & & 9 \\
\hline
1610 & 3 & 15 & 16 \\
\end{array}
$$

(4)...

$$1 \text{ guinea} = 42 \text{ sixpences}$$
$$14$$
$$12\overline{)588}$$
$$49 \text{ dozen}$$

(5)...

2s. 6d. $=\frac{1}{8}$ of £1
1s. 3d. $=\frac{1}{2}$ of 2s. 6d.
2d. $=\frac{1}{15}$ of 2s. 6d.

	£	s.	d.	
	2319	0	0	= value at £1 per sq. yd.
	289	17	6	
	144	18	9	
	19 ·	6	6	
	£454	2	9	

(6)...

$$\frac{5}{7}+\frac{4}{9}+\frac{8}{15} = \frac{225+140+168}{315} = \frac{533}{315} = 1\frac{218}{315}$$

$$7\frac{4}{9}-3\frac{5}{8} = 7\frac{32}{72}-3\frac{45}{72} = 3\frac{59}{72}$$

(7)...

$$\left(\tfrac{4}{9} \text{ of } \tfrac{8}{11} \text{ of } 3\tfrac{3}{5}\right) \times \left(\tfrac{5}{7} \text{ of } \tfrac{3}{8} \text{ of } 3\tfrac{9}{11}\right)$$

$$= \frac{4}{9} \times \frac{8}{11} \times \frac{\overset{2}{\cancel{18}}}{\cancel{5}} \times \frac{\cancel{5}}{7} \times \frac{3}{\cancel{8}} \times \frac{\overset{6}{\cancel{42}}}{11} = \frac{144}{121} = 1\frac{23}{121}$$

(8)...

	£	s.	d.	
	2	4	0	= value of 1 acre
		$11 \times 12 + 1 = 133$		
	24	4	0	
		12		
	290	8	0	

		£	s.	d.
2 roods	$=\frac{1}{2}$ of 1 acre	2	4	0
1 rood	$=\frac{1}{2}$ of 2 roods	1	2	0
20 per.	$=\frac{1}{2}$ of 1 rood		11	0
10 per.	$=\frac{1}{2}$ of 20 per.		5	6
5 per.	$=\frac{1}{2}$ of 10 per.		2	9
2½ per.	$=\frac{1}{2}$ of 5 per.		1	4½
				8¼
		£294	15	3¾

	s.	d.		£	s.	d.		cu. ft.		
(9)...	4	6	:	4	4	4½	::	1000	:	x
	12			20						
	54			84						
	2			12						
	108			1012						
				2						
				2025						

$$x = \frac{\overset{75}{\cancel{2025}} \times \overset{250}{\cancel{1000}}}{\underset{4}{\cancel{108}}} = 18750 \text{ cu. feet}$$

18750 ÷ 150 = 125 cubic feet per night

		s.	d.		£	s.	d.
(10)...	15 yds. flannel 1	9	=	1	6	3	
	12 pairs stockings...1	8	=	1	0	0	
	A's debt =	2	6	3			

	s.	d.		£	s.	d.
7 lb. tea 8	9	=	1	6	3	
9 lb. coffee ...1	6	=		13	6	
10 lb. sugar ...	5½	=		4	7	
B's debt =	2	4	4			

	£	s.	d.
	2	6	3
	2	4	4
A will have to pay B		1	11

EXERCISE LIII.

			£	s.	d.			hrs.	min.
(1)...	149 gui.	=	156	9	0	(2)...Monday	13	15
	237 sov.	=	237	0	0	Tuesday	24	0
	117 cr.	=	29	5	0	Wednesday	24	0
	235 hf. cr.	=	29	7	6	Thursday	24	0
	67 fl.	=	6	14	0	Friday	18	35
	346 sh.	=	17	6	0		103	50
	149 sixp.	=	3	14	6		60	
	77 fourp.	=	1	5	8		6230 min.	
		£481	1	8				

<center>t.   cwt.   qr.   lb.   oz.</center>

(3)...   43)15   18   1   27   3(7 cwt. 1 qr. 17 lb. 9 oz.

$$\begin{array}{r} 20 \\ \hline 318 \\ 301 \\ \hline 17 \\ 4 \end{array}$$

43)69(1 qr.

$$\begin{array}{r} 43 \\ \hline 26 \\ 28 \end{array}$$

43)755(17 lb.

$$\begin{array}{r} 43 \\ \hline 325 \\ 301 \\ \hline 24 \\ 16 \end{array}$$

43)387(9 oz.

$$\begin{array}{r} 387 \\ \hline \end{array}$$

(4)...

$$\begin{array}{rcc} & s. & d. \\ & 3 & 8 \text{ per lb.} \\ & 7 \times 11 + 2 = 79 \\ \hline 1 & 5 & 8 \\ & & 11 \\ \hline 14 & 2 & 4 \\ & 7 & 4 \\ 8 \text{ oz.} = & 1 & 10 \\ 4 \text{ oz.} = & & 11 \\ 2 \text{ oz.} = & & 5\frac{1}{2} \\ \hline £14 & 12 & 10\frac{1}{2} \end{array}$$

(5)...

$$\frac{3817}{5205} \div \frac{347}{347} = \frac{11}{15}$$

$$\frac{10894}{19693} \div \frac{419}{419} = \frac{26}{47}$$

$$\begin{array}{l} 5)7 \ \ 15 \ \ 19 \ \ 35 \\ 7)7 \ \ \ 3 \ \ 19 \ \ \cdot 7 \\ \hline \ \ 1 \ \ \ 3 \ \ 19 \ \ \ 1 \end{array}$$

L.C.M. $= 5 \times 7 \times 3 \times 19 = 1995$

(6)... $5\frac{3}{4} + 7\frac{2}{5} + 9\frac{1}{7} + 13\frac{5}{9} = 34 + \frac{3}{4} + \frac{2}{5} + \frac{1}{7} + \frac{5}{9}$

$$= 34 + \frac{945 + 504 + 180 + 700}{1260}$$

$$= 34 + \frac{2329}{1260}$$

$$= 35\frac{1069}{1260}$$

<center>H</center>

			s.	*d.*		*s.*	*d.*
(7)...	6	prs. Cotton Hose	2	3 =		13	6
	4	„ Lambswool Hose ...	2	9 =		11	0
	9	„ Cotton Half-hose ...	1	6 =		13	6
	6	„ Kid Gloves	2	9 =		16	6
	$7\frac{1}{2}$	yds. Flannel	1	9 =		13	$1\frac{1}{2}$
	4	Silk Handkerchiefs	4	3 =		17	0

$$£4 \quad 4 \quad 7\frac{1}{2}$$

(8)...
$$65 \text{ gallons} = 520 \text{ pints}$$

$$520 \div 1\frac{5}{8} = \frac{\overset{40}{\cancel{520}}}{1} \times \frac{8}{\cancel{13}} = 320 \text{ bottles}$$

(9)...

cwt.	qrs.	lb.		lb.		*s.*	*d.*		
2	3	21	:	112	::	3	11	:	x
4						12			
11						47			
28									
329									

$$x = \frac{\overset{16}{\cancel{112}} \times \cancel{47}}{\underset{\underset{7}{\cancel{329}}}{}} = 16d. = 1s.\ 4d. \text{ per cwt.}$$

(10)...

	mi.			mi.				hr.	min.
	$5\frac{1}{2}$	at the rate of	4	per hour would occupy				1	$22\frac{1}{2}$
	$81\frac{1}{4}$	„	25	„		„		3	15
	$8\frac{1}{4}$	„	6	„		„		1	$22\frac{1}{2}$
	95 miles		time occupied by journey	=				6	0

Average rate per hour = $95 \div 6 = 15\frac{5}{6}$ miles

EXERCISE LIV.

(1)... 1. $(703 - 419 + 215) \times (614 + 219 - 376)$
  $= 589 \times 457$
  $= 269173$

2. $(24263 - 9879 + 11337) \div (826 - 537)$
  $= 25721 \div 289$
  $= 89$

(2)...

<div align="center">

ac. ro. po.
9 3 36
4
—————
39
40
—————
1596
30¼
—————
47880
399
—————
48279

</div>

yds. hf. yds.   2
$115\frac{1}{2} = 231)\overline{96558}(418$ yards
924
—————
415
231
—————
1848
1848
—————

(3)...   36 gallons at 5d. per quart =

	£	s.	d.
	3	0	0
cost	2	0	6
profit		19	6

(4)...

	£	s.	d.	
	1	17	6	
			9	
	16	17	6	value of 1 ox
			4	
3)	67	10	0	value of 4 oxen
	£22	10	0	value of each horse

(5)... $\frac{11}{16}-\frac{7}{13} = \frac{143}{208}-\frac{112}{208} = \frac{31}{208}$; $9-4\frac{6}{7} = 4\frac{1}{7}$;

$13\frac{2}{9}-8\frac{5}{7} = 13\frac{14}{63}-8\frac{45}{63} = 4\frac{32}{63}$

(6)... $(\frac{5}{9} \text{ of } \frac{7}{12} \text{ of } 3\frac{3}{4}) \times (\frac{3}{14} \text{ of } \frac{4}{5} \text{ of } 8)$

$= \frac{5}{9} \times \frac{7}{12} \times \frac{15}{4} \times \frac{3}{14} \times \frac{4}{5} \times \frac{8}{1} = \frac{5}{3} = 1\frac{2}{3}$

(7)...
$$\tfrac{7}{8}\text{ gui.} = \tfrac{7}{8} \times \tfrac{21}{1} = \overset{s.}{\underset{}{1}}\tfrac{147}{8} = \overset{s.\quad d.}{18 \ \ 4\tfrac{1}{2}};$$

$$\tfrac{5}{12}\text{ sov.} = \tfrac{5}{12} \times \tfrac{20}{1} = \tfrac{100}{12} = \ \ 8 \ \ 4;$$

$$\tfrac{9}{16}\text{ cro.} = \tfrac{9}{16} \times \tfrac{5}{1} = \tfrac{45}{16} = \ \ 2 \ \ 9\tfrac{3}{4}$$

(8)...
$$\overset{\text{men}}{20} \ : \ \overset{\text{men}}{15} \ :: \ \overset{\text{da.}}{42} \ : \ x$$

$$x = \frac{\overset{3}{\cancel{15}} \times \overset{21}{\cancel{42}}}{\underset{\underset{2}{4}}{\cancel{20}}} = \frac{63}{2}\text{ da.} = 31\tfrac{1}{2}\text{ da.} \quad Ans. \ \overset{\text{da.}}{31\tfrac{1}{2}} \times 2 = 63$$

(9)...

s.	d.			£	s.	d.	
5	0	$=\tfrac{1}{4}$ of £1		1752	0	0	= value at £1 eac
2	6	$=\tfrac{1}{2}$ „	5s.	438	0	0	
	7½	$=\tfrac{1}{4}$ „	2s. 6d.	219	0	0	
				54	15	0	
				£711	15	0	

s.	d.			£	s.	d.	
10	0	$=\tfrac{1}{2}$ of £1		967	0	0	= value at £1 eae
5	0	$=\tfrac{1}{2}$ „	10s.	483	10	0	
2	6	$=\tfrac{1}{2}$ „	5s.	241	15	0	
	5	$=\tfrac{1}{6}$ „	2s. 6d.	120	17	6	
	¼	$=\tfrac{1}{20}$ „	5d.	20	2	11	
				1	0	1¾	
				£867	5	6¾	

s.	d.			£	s.	d.	
10	0	$=\tfrac{1}{2}$ of £1		589	0	0	= value at £1 ea
						3	
				1767	0	0	
2	6	$=\tfrac{1}{4}$ „	10s.	294	10	0	
1	3	$=\tfrac{1}{2}$ „	2s. 6d.	73	12	6	
	2½	$=\tfrac{1}{6}$ „	1s. 3d.	36	16	3	
				6	2	8½	
				£2178	1	5½	

(10)...   5 doz. Port........48 = 240
           6 „   Sherry.....38 = 228
                        104)468(4s 6d. per yard
                            416
                            ‾‾‾
                             52
                             12
                        104)624(6d.
                            624
                            ‾‾‾

EXERCISE LV.

(1)...   129
              329
             ‾‾‾‾
             1161
              258
              387
           47)42441(903
              423
             ‾‾‾‾
              141
              141
              ‾‾‾
or thus,

               7
           129 × 329
           ‾‾‾‾‾‾‾‾‾ = 903
              47

(2)...   28)756439 lb.
          4) 27015 19 lb.
         20) 6753   3 qrs.
            ‾‾‾‾‾‾
              337 13 cwt.

Ans. 337 t. 13 cwt. 3 qrs. 19 lb.

(3)... 793 sixpences = £19 16 6 (£ s. d.)
        113 hf. crowns = 14 2 6
                        ‾‾‾‾‾‾‾‾
                        £5 14 0

(4)...   629)777(1
            629
           ‾‾‾‾
           148)629(4
               592
              ‾‾‾
               37)148(4
                  148
                  ‾‾‾

G.C.M. of 629 and 777 = 37

        37)1073(29
           74
          ‾‾‾
          333
          333
          ‾‾‾

G.C.M. required = 37

        3)17 25 36 51 85
        5)17 25 12 17 85
       17)17 5 12 17 17
          ‾‾‾‾‾‾‾‾‾‾‾‾‾‾
           1 5 12 1 1

L.C.M. = 3 × 5 × 17 × 5 × 12 = 15300

(5)...
$$\frac{25}{42} \div \frac{5}{12} = \frac{\overset{5}{\cancel{25}}}{\underset{7}{\cancel{42}}} \times \frac{\overset{2}{\cancel{12}}}{\cancel{5}} = \frac{10}{7} = 1\frac{3}{7}$$

$$2\frac{2}{7} \div 6\frac{2}{5} = \frac{\cancel{16}}{7} \times \frac{5}{\underset{2}{\cancel{32}}} = \frac{5}{14}$$

(6)...
$$2\frac{3}{4} \quad : \quad 7\frac{6}{7} \quad :: \quad x \quad : \quad 19\frac{9}{14}$$

$$x = (2\tfrac{3}{4} \times 19\tfrac{9}{14}) \div 7\tfrac{6}{7} = \frac{11}{4} \times \frac{\overset{5}{\cancel{275}}}{\underset{2}{\cancel{14}}} \times \frac{7}{\cancel{55}} = \frac{55}{8} = 6\frac{7}{8}$$

(7)...

$$12\tfrac{1}{2} \text{ gui.} = \begin{array}{ccc} \pounds & s. & d. \\ 13 & 2 & 6 \end{array}$$

$$5 \times 5 = 25$$

$$\begin{array}{ccc} \hline 65 & 12 & 6 \\ & & 5 \\ \hline 328 & 2 & 6 \end{array} \text{ value of 25 oxen}$$

190   0   0

65)138   2   6(£2 2s. 6d. each sheep
130
  8
 20
65)162(2s.
130
 32
 12
65)390(6d.
390

(8)...
$$\begin{array}{cccc} \text{hrs. da.} & \text{hrs.} & \text{tr.} & \text{tr.} \\ 10 \times 7 \; : & 24 \times x \; :: & 35 \; : & 108 \end{array}$$

$$x = \frac{\overset{1}{\cancel{10}} \times 7 \times \overset{9}{\cancel{108}}}{\underset{1}{\cancel{24}} \times \underset{5}{\cancel{35}}} = 9 \text{ days}$$

(9)...
$$12\tfrac{3}{4} + 9\tfrac{3}{4} + 7\tfrac{1}{2} = 30$$

1 sovereign ÷ 30 = 8d.

$8d. \times 12\tfrac{3}{4} = 8s.\ 6d.$, John's share
$8d. \times\ 9\tfrac{3}{4} = 6s.\ 6d.$, George's share
$8d. \times\ 7\tfrac{1}{2} = 5s.\ 0d$, Edward's share

(10)...

	£	s.	d.
1 quarter malt	3	10	0
10 lb. hops at 2s. 6d.	1	5	0
	£4	15	0

	£	s.	d.
3 bar. = 108 gal. at 16d. =	7	4	0
cost	4	15	0
profit	£2	9	0

EXERCISE LVI.

(1)...

```
ac.  ro.  po.  yds.
 9    2   27   19¼          Proof.
 4                      46816 sq. yds.
38                          4
 40     yds.   qrs.  ⌠ 11)187264
1547   30¼=121  {  11)17024
  30¼                ⌊  40)1547  7 ⌉ 77 qrs.=19¼ yds.
46429¼                      4)38  27 poles
  386¾              9 ac. 2 ro. 27 po. 19¼ yds.
46816 sq. yds.
```

(2)...

```
                cu. in.
            ⌠ 12)3685824
       1728 {  12)307152
            ⌊  12)25596

          27 ⌠ 3)2133 cu. ft.
             { 9)711
               79 cu. yds.
```

$$
\begin{array}{r}
\text{w.} \quad \text{da. hrs. min. sec.}
\end{array}
$$

(3)...
$$
315\begin{cases}
5)5616 & 2\ 23\ \ 3\ \ 0 \\
7)1123 & 1\ 23\ 48\ 36 \\
9)160 & 3\ \ 6\ 49\ 48
\end{cases}
$$
$$
\overline{17\quad 5\ 19\ 25\ 32}
$$

Ans. 17 w. 5 da. 19 hrs. 25 min. 32 sec.

(4)...
$$
\frac{13}{18}\text{ gui.} = \frac{13}{\overset{\cancel{18}}{6}} \times \frac{\overset{7}{\cancel{21}}}{1} = \frac{91}{6} = \overset{£\ \ s.\ \ d.}{0\ 15\ \ 2}
$$

$$
\frac{19}{24}\text{ sov.} = \frac{19}{\underset{6}{\cancel{24}}} \times \frac{\overset{5}{\cancel{20}}}{1} = \frac{95}{6} = \frac{0\ 15\ 10}{£1\ 11\ \ 0}
$$

(5)...1.
$$
\begin{array}{l}
\overset{s.\quad d.}{10\ \ 0} = \tfrac{1}{2}\text{ of } £1 \\
1\ 8 = \tfrac{1}{6}\text{ of } 10s. \\
2\tfrac{1}{2} = \tfrac{1}{8}\text{ of } 1s.\ 8d.
\end{array}
\qquad
\begin{array}{l}
\overset{£\quad s.\quad d.}{547\ \ 0\ \ 0} = \text{value at } £1 \text{ per yd} \\
273\ 10\ \ 0 \\
45\ 11\ \ 8 \\
\ \ 5\ 13\ 11\tfrac{1}{2} \\
\overline{£324\ 15\ \ 7\tfrac{1}{2}}
\end{array}
$$

2.
$$
\begin{array}{l}
\overset{\text{qr.lb.}}{1\ 0} = \tfrac{1}{4}\text{ of } 1\text{ cwt.} \\
\\
14 = \tfrac{1}{2}\text{ of } 1\text{ qr.} \\
7 = \tfrac{1}{2}\text{ of } 14\text{ lb.} \\
3\tfrac{1}{2} = \tfrac{1}{2}\text{ of } 7\text{ lb.}
\end{array}
\qquad
\begin{array}{l}
\overset{£\quad s.\quad d.}{4\ \ 4\ \ 0}\text{ per cwt.} \\
\qquad\quad 4 \\
\overline{16\ 16\ \ 0} \\
1\ \ 1\ \ 0 \\
\ \ 10\ \ 6 \\
\ \ \ 5\ \ 3 \\
\ \ \ 2\ \ 7\tfrac{1}{2} \\
\overline{£18\ 15\ \ 4\tfrac{1}{2}}
\end{array}
$$

3.
$$
\begin{array}{l}
\overset{\text{ro.\ per.}}{2\ \ 0} = \tfrac{1}{2}\text{ of } 1\text{ ac.} \\
\\
\\
\\
\\
20 = \tfrac{1}{4}\text{ of } 2\text{ ro.} \\
5 = \tfrac{1}{4}\text{ of } 20\text{ p.}
\end{array}
\qquad
\begin{array}{l}
\overset{£\quad s.\quad d.}{1\ 16\ \ 0}\text{ per acre} \\
\qquad 12 \times 12 + 5 = 149 \\
\overline{21\ 12\ \ 0} \\
\qquad\quad 12 \\
\overline{259\ \ 4\ \ 0} \\
9\ \ 0\ \ 0 \\
\ \ 18\ \ 0 \\
\ \ \ 4\ \ 6 \\
\ \ \ 1\ \ 1\tfrac{1}{2} \\
\overline{£269\ \ 7\ \ 7\tfrac{1}{2}}
\end{array}
$$

		$s.$	$d.$		$£$	$s.$	$d.$
(6)... 12 Mahogany chairs...........		32	6	=	19	10	0
2 Arm-chairs		38	6	=	3	17	0
$49\frac{1}{2}$ yds. Brussels carpeting...		4	10	=	11	19	3
1 Hearth-rug						1	8	6
18 yds. Crimson damask......		3	9	=	3	7	6
					$£40$	2	3

(7)...

$$\frac{5}{9} \quad : \quad \frac{3}{16} \quad :: \quad \overset{£}{102}25 \quad : \quad x$$

$$\frac{9}{\cancel{5}} \times \frac{3}{16} \times \frac{\overset{2045}{\cancel{10225}}}{1} = £\frac{55215}{16} = £3450 \; 18s. \; 9d.$$

(8)...

$$\overset{s. \quad da.}{62 \times 14} \quad : \quad \overset{s. \quad da.}{126 \times 62} \quad :: \quad \overset{t.}{3} \quad : \quad x$$

$$x = \frac{\overset{9}{\cancel{126}} \times \cancel{62} \times 3}{\cancel{62} \times \cancel{14}} = 27 \text{ tons}$$

(9)...   The first is to receive *a certain sum;*

The second £117 9*s.* 6*d.* less than this sum;

The third (£117 9*s.* 6*d.* + £94 7*s.* 6*d.*) less.

	$£$	$s.$	$d.$
	1358	11	0

$£$	$s.$	$d.$		$£$	$s.$	$d.$
117	9	6 ⎫				
117	9	6 ⎬ =	329	6	6
94	7	6 ⎭				

3)1687 17 6

The first will receive   £562 12 6

117 9 6

The second   „   £445 3 0

94 7 6

The third   „   £350 15 6

(10)...From noon to 8 A.M. on the following day = 20 hours

The clock will gain $\dfrac{20}{24}$ or $\dfrac{5}{6}$ of $4\frac{1}{2}$ min. in 20 hours

$$\dfrac{5}{6} \text{ of } 4\overset{\text{min.}}{\frac{1}{2}} = \dfrac{5}{\underset{2}{\cancel{6}}} \times \dfrac{\overset{3}{\cancel{9}}}{2} = \dfrac{15}{4} = 3\frac{3}{4} \text{ minutes}$$

∴ the hands must be set at $3\frac{3}{4}$ minutes before 12

EXERCISE LVII.

(1)...
```
     far.
  4)236565
 12)59141¼
  21)4928  5¼
 gui. 234 14s. 5¼d.
```

(2)...
ac.	ro.	po.	yds.
79	2	24	15

$$3 \times 6 + 1 = 19$$

```
  238   3  33  14¾
                6
 1433   3   0  28
   79   2  24  15
 1513   1  25  12¾
```

(3)... From March 19 to May 31 = 73 days = $\frac{1}{5}$ year

```
      £   s.  d.
   5)13   2   6  = 12½ guineas
     £2  12   6
```

(4)...

$$\left(\tfrac{5}{8} \text{ of } \tfrac{7}{10}\right) \times \left(\tfrac{3}{5} \text{ of } \tfrac{10}{11}\right)$$

$$= \dfrac{\cancel{5}}{8} \times \dfrac{7}{\cancel{10}} \times \dfrac{3}{\cancel{5}} \times \dfrac{\cancel{10}}{11} = \dfrac{21}{88};$$

$$\left(\tfrac{4}{5} \text{ of } 6\tfrac{1}{4}\right) \times \left(\tfrac{3}{7} \text{ of } 2\tfrac{4}{5}\right)$$

$$= \dfrac{4}{\cancel{5}} \times \dfrac{\overset{5}{\cancel{25}}}{\cancel{4}} \times \dfrac{3}{7} \times \dfrac{\overset{2}{\cancel{14}}}{\cancel{5}} = 6$$

(5)...
$$2 \text{ qrs. } 19\tfrac{1}{4} \text{ lb.} = 301 \text{ quarter lb.}$$
$$1 \text{ cwt.} = 448 \qquad \text{,,}$$
$$\frac{301}{448} = \frac{43}{64} \text{ of a cwt.}$$

$$\frac{23}{28}\text{gui.} = \frac{23}{\cancelto{4}{28}} \times \frac{\cancelto{3}{21}}{1} = \frac{69}{4}s. = 17s.\ 3d.$$

(6)...
£	s.	d.
2	15	0
1	10	6

$$£200\ 18s.\ 6d. + £4\ \ 5\ \ 6 = 47$$

∴ the number of persons $= 47 \times 2 = 94$

(7)...

£	s.	d.	
5	10	0	per cwt.

$$4 \times 4 + 1 = 17$$

22	0	0
		4

qr.	lb.			88	0	0
2	0	$=\tfrac{1}{2}$ of 1 cwt.		5	10	0
1	0	$=\tfrac{1}{2}$ of 2 qrs.		2	15	0
	14	$=\tfrac{1}{2}$ of 1 qr.		1	7	6
	$3\tfrac{1}{2}$	$=\tfrac{1}{4}$ of 14 lb.			13	9
					3	$5\tfrac{1}{4}$
			£98	9	$8\tfrac{1}{4}$

(8)...

per.	da.		per.	da.		£	
8×15		:	14×42		::	39	. x

$$x = \frac{\cancelto{7}{14} \times \cancelto{\cancelto{7}{14}}{42} \times 39}{\underset{\underset{2}{4}}{\cancel{8}} \times \underset{5}{\cancel{15}}} = £\frac{1911}{10} = £191\ 2s.$$

(9)...　　　Value of 1 sheep = $\frac{3}{5}$ of that of a calf

∴ 13 sheep are equal in value to ($\frac{3}{5} \times 13 =$) $\frac{39}{5}$ calves
and 27　　　　　„　　　　　„　　　($\frac{3}{5} \times 27 =$) $\frac{81}{5}$　　„

$$5 + \frac{39}{5} = \frac{64}{5}; \quad 7 + \frac{81}{5} = \frac{116}{5}$$

$$\overset{c.}{\frac{64}{5}} \quad : \quad \overset{c.}{\frac{116}{5}} \quad :: \quad \overset{£}{36} \quad \overset{s.}{16} = 36\frac{4}{5} \quad : \quad \overset{£}{x}$$

$$x = \frac{\overset{}{\cancel{5}}}{\underset{\underset{2}{\cancel{8}}}{\cancel{64}}} \times \frac{\overset{29}{\cancel{116}}}{\cancel{5}} \times \frac{\overset{23}{\cancel{184}}}{5} = £\frac{667}{10} = £66 \ 14s.$$

(10)...　　He walked 10 miles in 2 hrs. 40 min. or 160 min.

∴ he walked at the rate of 1 mile in 16 minutes

$$\text{time occupied by journey} = \overset{\text{min.}}{16} \times 22 = \overset{\text{min.}}{352} = 5 \text{ hrs. } 52 \text{ min.}$$

5 hrs. 52 min. + 30 min. = 6 hrs. 22 min.

hence he reached Windsor at 22 min. past 3

EXERCISE LVIII.

(1)...

			s.	d.	£	s.	d.
$4\frac{1}{4}$ lb.	Jamaica coffee	...1	8	= 0	7	1
$3\frac{1}{2}$ „	Mocha　„	...1	10	= 0	6	5
$2\frac{1}{2}$ „	Tea..............	4	4	= 0	10	10
15 „	Sugar	0	$5\frac{1}{2}$	= 0	6	$10\frac{1}{2}$
$3\frac{1}{2}$ „	Honey	1	3	= 0	4	$4\frac{1}{2}$
6 „	Treacle	0	4	= 0	2	0
4 boxes	Sardines	1	2	= 0	4	8
					£2	2	3

(2)...　　1 gui. + 1 sov. + 1 cr. + 1 fl. = £2 8s. = 2304 far.

```
2304)292608(127 of each coin
     2304
     ‾‾‾‾
     6220
     4608
     ‾‾‾‾
    16128
    16128
    ‾‾‾‾‾
```

(3)...

$$4\tfrac{7}{12}+3\tfrac{3}{8} = 4\tfrac{14}{24}+3\tfrac{9}{24} = 7\tfrac{23}{24}, \text{ sum}$$

$$4\tfrac{7}{12}-3\tfrac{3}{8} = 4\tfrac{14}{24}-3\tfrac{9}{24} = 1\tfrac{5}{24}, \text{ difference}$$

$$4\tfrac{7}{12}\times 3\tfrac{3}{8} = \frac{55}{\cancel{12}}\times\frac{\overset{9}{\cancel{27}}}{8} = \frac{495}{32} = 15\tfrac{15}{32}, \text{ product}$$
$$\underset{4}{}$$

$$4\tfrac{7}{12}\div 3\tfrac{3}{8} = \frac{55}{\cancel{12}}\times\frac{\overset{2}{\cancel{8}}}{27} = \frac{110}{81} = 1\tfrac{29}{81}, \text{ quotient}$$
$$\underset{3}{}$$

$$7\tfrac{23}{24}+1\tfrac{5}{24}+15\tfrac{15}{32}+1\tfrac{29}{81}$$

$$= 24+\tfrac{23}{24}+\tfrac{5}{24}+\tfrac{15}{32}+\tfrac{29}{81}$$

$$= 24+\frac{2484+540+1215+928}{2592}$$

$$= 24+\tfrac{5167}{2592}$$

$$= 24+1\tfrac{2575}{2592}$$

$$= 25\tfrac{2575}{2592}$$

(4)...

1. $\tfrac{3}{5}+\tfrac{7}{10}-\tfrac{11}{30}+\tfrac{8}{15} = \tfrac{18}{30}+\tfrac{21}{30}-\tfrac{11}{30}+\tfrac{16}{30}$

$$= \tfrac{44}{30} = \tfrac{22}{15} = 1\tfrac{7}{15}$$

2. $\left(1\tfrac{5}{9}-2\tfrac{1}{6}+3\tfrac{7}{12}\right)\times\tfrac{18}{25}$

$$= \left(1\tfrac{20}{36}-2\tfrac{6}{36}+3\tfrac{21}{36}\right)\times\tfrac{18}{25}$$

$$= 2\tfrac{35}{36}\times\tfrac{18}{25}$$

$$= \frac{107}{\underset{2}{\cancel{36}}}\times\frac{\cancel{18}}{25}$$

$$= \tfrac{107}{50} = 2\tfrac{7}{50}$$

(5)...

$$\tfrac{7}{20} \text{ mi.} = \frac{7}{\cancel{20}}\times\frac{\overset{88}{\cancel{1760}}}{1} = \overset{\text{yds.}}{616}$$

$$\tfrac{8}{11} \text{ fur.} = \frac{8}{\cancel{11}}\times\frac{\overset{20}{\cancel{220}}}{1} = \frac{160}{456} \text{ yards}$$

(6)...

$$\begin{array}{cccccccccc} s. & d. & & \pounds & s. & d. & & \pounds & & \\ 1 & 6 & : & 380 & 1 & 3 & :: & 1 & : & x \\ 12 & & & 20 & & & & & & \\ \hline 18 & & & 7601 & & & & & & \\ & & & 12 & & & & & & \\ \hline & & & 91215 & & & & & & \end{array}$$

$$x = \frac{91215}{18} = \pounds 5067 \ 10s.$$

(7)...

$$\frac{\overset{5}{\cancel{140}} \times \overset{21}{\cancel{84}}}{\underset{4}{\cancel{112}}} = 105 \text{ yards}$$

(8)...

$$\begin{array}{ccc} \pounds & s. & d. \\ 3 & 17 & 6 \text{ per ounce} \end{array}$$

$$3 \times 6 + 1 = 19$$

$$\begin{array}{ccc} \hline 11 & 12 & 6 \\ & & 6 \end{array}$$

dwt.	grs.			£	s.	d.
				69	15	0
10	0	= ½ of 1 oz.		3	17	6
5	0	= ½ of 10 dwt.		1	18	9
2	12	= ½ of 5 dwt.		0	19	4½
				0	9	8¼
				£77	0	3¾

qrs.	lb.			£	s.	d.
2	0	= ½ of 1 cwt.		3	10	0 per cwt.
					13	
				45	10	0
1	0	= ½ of 2 qrs.		1	15	0
	14	= ½ of 1 qr.		0	17	6
	3½	= ¼ of 14 lb.		0	8	9
				0	2	2¼
				£48	13	5¼

bu.	pks.			£	s.	d.
4	0	= ½ of 1 qr.		2	16	0 per qr.
					11	
				30	16	0
1	0	= ¼ of 4 bu.		1	8	0
	2	= ½ of 1 bu.		0	7	0
				0	3	6
				£32	14	6

$$\begin{array}{r} £ \quad s. \quad d. \\ 18)\overline{229 \ 10 \ \ 0} \end{array}$$

(9)...

$$\begin{array}{l} 12 \ \overline{15} \ \ 0 \ \text{cost of each ox} \\ \underline{ 5} \\ £63 \ \overline{15} \ \ 0 \ \text{produce of 5 oxen} \end{array}$$

$$\begin{array}{l} £ \quad s. \quad d. \\ 229 \ 10 \ \ 0 \\ \underline{63 \ 15 \ \ 0} \\ \overline{165 \ 15 \ \ 0} \ \text{cost of 13 oxen} \\ \underline{32 \ 10 \ \ 0} \ \text{required profit} \\ 13)\overline{198 \ \ 5 \ \ 0} \\ \overline{£15 \ \ 5 \ \ 0} \ \text{each} \end{array}$$

(10)...
$$\begin{array}{c} \text{hrs. wks.} \qquad \text{hrs. wks.} \qquad £ \quad s. \\ 11 \times 8 \quad : \quad 14 \times 9 \quad :: \quad 42 \quad 7 \quad : \quad x \\ \underline{20} \\ \overline{847} \end{array}$$

$$x = \frac{\overset{7}{\cancel{14}} \times 9 \times \overset{77}{\cancel{847}}}{\underset{4}{\cancel{11} \times \cancel{8}}} = \frac{4851}{4}s. = £60 \ 12s. \ 9d.$$

EXERCISE LIX.

(1)...
$$\begin{array}{l} \text{in.} \\ 12)\overline{4876329} \\ 3)\overline{406360} \quad 9 \text{ in.} \\ 220)\overline{135453} \quad 1 \text{ ft.} \\ 8)\overline{615} \quad 153 \text{ yds.} \\ \overline{76} \quad 7 \text{ fur.} \end{array}$$

Ans. 76 mi. 7 fur. 153 yds. 1 ft. 9 in.

(2)...
$$\frac{561}{759} + \frac{33}{33} = \frac{17}{23};$$

$$\frac{1645}{2209} \div \frac{47}{47} = \frac{35}{47};$$

$$\frac{1166}{2067} + \frac{53}{53} = \frac{22}{39}$$

(3) ..
$$\begin{array}{l} 2)\overline{15, \ 12, \ 20, \ 18, \ 30} \\ 2)\overline{15, \ \ 6, \ 10, \ \ 9, \ 15} \\ 3)\overline{15, \ \ 3, \ \ 5, \ \ 9, \ 15} \\ 5)\overline{\ 5, \ \ 1, \ \ 5, \ \ 3, \ \ 5} \\ \overline{\ 1, \ \ 1, \ \ 1, \ \ 3, \ \ 1} \end{array}$$

L.C.D. $= 2 \times 2 \times 3 \times 5 \times 3 = 180$

$\therefore \ \frac{7}{15}, \ \frac{5}{12}, \ \frac{13}{20}, \ \frac{11}{18}, \ \frac{19}{30} = \frac{84}{180}, \ \frac{75}{180}, \ \frac{117}{180}, \ \frac{110}{180}, \ \frac{114}{180}$

(4)...
$$1\tfrac{2}{3} \div (\tfrac{5}{12} \text{ of } \tfrac{6}{11})$$

$$\frac{5}{3} \times \frac{\overset{2}{\cancel{12}}}{\cancel{5}} \times \frac{11}{\cancel{6}} = \frac{22}{3} = 7\tfrac{1}{3}$$

(5)...
$$\tfrac{2}{7} \quad : \quad \tfrac{11}{12} \quad :: \quad \overset{\pounds}{300} \quad : \quad x$$

$$x = \frac{7}{2} \times \frac{11}{\cancel{12}} \times \frac{\overset{25}{\cancel{300}}}{1} = \pounds\frac{1925}{2} = \pounds962 \ 10s.$$

(6)...

cwt.	qr.	lb.		lb.		£	s.	d.		
2	1	22	:	1	::	5	2	9	:	x

$$\begin{array}{r} 4 \\ \hline 9 \\ 28 \\ \hline 274 \end{array} \qquad \begin{array}{r} 20 \\ \hline 102 \\ 12 \\ \hline 1233 \end{array}$$

$$x = \frac{1233}{274} = 4\tfrac{1}{2}d. \text{ per lb.}$$

(7)...

ac.	ro.	per.	yds.
1	3	34	5½

$$\begin{array}{r} 4 \\ \hline 7 \\ 40 \\ \hline 314 \\ 30\tfrac{1}{4} \\ \hline 9425\tfrac{1}{2} \\ 78\tfrac{1}{2} \\ \hline \end{array}$$

$$528)9504(18 \text{ hours}$$
$$\begin{array}{r} 528 \\ \hline 4224 \\ 4224 \\ \hline \end{array}$$

(8)...

					s.	d.		£	s.	d.
51 yds.	Brussels carpeting	at	4	9	=	12	2	3
39 ,,	Kidderminster ,,	at	3	3	=	6	6	9
	difference in expense	=	£5	15	6

(9)...　　Cost of 1 qr. of each $= \overset{s.}{66} + \overset{s.}{48} + \overset{s.}{30} = \overset{s.}{144}$

$£540 = 10800s.$

$10800 \div 144 = 75$, quarters of each

(10)...

$$\overset{men\ da.}{13 \times 4} : \overset{men\ da.}{x \times 2} :: \overset{ac.}{32\tfrac{1}{2}} : \overset{ac.}{21\tfrac{1}{4}}$$

$$\begin{array}{cc} & 4 & 4 \\ & \overline{130} & \overline{85} \end{array}$$

$$x = \frac{\overset{17}{\cancel{13} \times \cancel{4} \times \cancel{85}}}{\underset{\underset{\cancel{2}}{\cancel{10}}}{\cancel{2} \times \cancel{130}}} = 17 \text{ men}$$

EXERCISE LX.

		£	s.	d.
(1)...	137 guineas .... =	143	17	0
	119 sovereigns......... =	119	0	0
	83 half-guineas ...... =	43	11	6
	59 half-sovereigns ... =	29	10	0
	157 crowns .... =	39	5	0
	225 half-crowns ...... =	28	2	6
	97 florins .... =	9	14	0
	353 shillings .... =	17	13	0
		£430	13	0

(2)...　　$(89)^2 \times (37)^3 = 89 \times 89 \times 37 \times 37 \times 37$

$= 401222413$

(3)...

$$\begin{array}{r} \text{grs.} \\ 24)\overline{4245070} \\ 20)\overline{176877} \quad 22 \text{ grs.} \\ 12)\overline{8843} \quad 17 \text{ dwts.} \\ \overline{736} \quad 11 \text{ oz.} \end{array}$$

Ans. 736 lb. 11 oz. 17 dwts. 22 grs.

I

(4)...

$$
\begin{array}{ccccccccccc}
£ & s. & d. & & s. & & £ & s. & d. & \\
1256 & 13 & 4 & : & 20 & :: & 267 & 0 & 10 & : & x \\
20 & & & & & & 20 & & & \\
\hline
25133 & & & & & & 5340 & & & \\
12 & & & & & & 12 & & & \\
\hline
301600 & & & & & & 64090 & & &
\end{array}
$$

$$
x = \frac{\overset{17}{\cancel{20} \times \cancel{64090}}}{\underset{\underset{4}{\cancel{15080}}}{\cancel{301600}}} = \tfrac{17}{4}s. = 4s.\ 3d.\ \text{in the pound}
$$

(5)...

$$
\begin{array}{lcc}
& s. & d. \\
\text{2 Poor rates} & = 3 & 0 \\
\text{Highway rate} & 0 & 6 \\
\text{Church rate} & 0 & 4\tfrac{1}{2} \\
\hline
& 3 & 10\tfrac{1}{2} \text{ in the pound} \\
& 5 \times 11 & = 55 \\
\hline
& 19 & 4\tfrac{1}{2} \\
& 11 & \\
\hline
£10\ \ 13 & 1\tfrac{1}{2}
\end{array}
$$

(6)...

$$
1 - (\tfrac{5}{7} \text{ of } \tfrac{14}{15} \text{ of } \tfrac{13}{20})
$$

$$
1 - \left(\frac{\cancel{5}}{7} \times \frac{\overset{2}{\cancel{14}}}{\cancel{15}} \times \frac{13}{\underset{10}{\cancel{20}}} \right)
$$
$$
\phantom{1 - \left(\frac{5}{7} \times \right.} 3 10
$$

$$
1 - \tfrac{13}{30} = \tfrac{17}{30}
$$

(7)...

$$
2\tfrac{3}{8} + 3\tfrac{5}{9} + 5\tfrac{7}{10} = 10 + \tfrac{3}{8} + \tfrac{5}{9} + \tfrac{7}{10}
$$

$$
= 10 + \frac{135 + 200 + 252}{360}
$$

$$
= 10 + \tfrac{587}{360}
$$

$$
= 10 + 1\tfrac{227}{360}
$$

$$
= 11\tfrac{227}{360}
$$

$$
5\tfrac{11}{18} - 1\tfrac{7}{12} = 5\tfrac{22}{36} - 1\tfrac{21}{36} = 4\tfrac{1}{36}
$$

(8)...
$$\left(\tfrac{5}{9} \text{ of } \tfrac{7}{10} \text{ of } 6\tfrac{2}{11}\right) \times \left(\tfrac{9}{28} \text{ of } \tfrac{11}{17} \text{ of } 7\tfrac{1}{2}\right)$$

$$= \frac{5}{9} \times \frac{7}{10} \times \frac{68}{11} \times \frac{9}{28} \times \frac{11}{17} \times \frac{15}{2}$$

$$= \tfrac{15}{4} = 3\tfrac{3}{4};$$

$$\left(\tfrac{15}{26} \text{ of } \tfrac{13}{18} \text{ of } 7\tfrac{1}{5}\right) \div \left(\tfrac{6}{7} \text{ of } \tfrac{8}{5} \text{ of } 5\tfrac{3}{5}\right)$$

$$= \frac{15}{26} \times \frac{13}{18} \times \frac{36}{5} \times \frac{7}{6} \times \frac{8}{5} = \frac{5}{28}$$

$$= 1$$

(9)...
$$4s.\ 8\tfrac{1}{4}d. = 225 \text{ farthings}$$
$$1 \text{ sov.} = 960 \text{ farthings}$$

$$\tfrac{225}{960} = \tfrac{15}{64} \text{ of a sovereign}$$

$$\frac{17}{28} \text{cwt.} = \frac{17}{28} \times \frac{112}{1} = 68 \text{ lb.} = 2 \text{ qrs. } 12 \text{ lb.}$$

(10)...
$$\frac{4}{7} - \frac{4}{9} = \frac{36-28}{63} = \frac{8}{63}$$

$$\tfrac{8}{63} = 32 \text{ gallons}$$

$$\tfrac{8}{63} \quad : \quad 1 \quad :: \quad \overset{\text{gal.}}{32} \quad : \quad x$$

$$x = \frac{63}{8} \times \frac{32}{1} = 252 \text{ gallons}$$

EXERCISE LXI.

(1)... $\frac{1302}{1705} \div \frac{31}{31} = \frac{42}{55}$; $\frac{2014}{3551} \div \frac{53}{53} = \frac{38}{67}$;

```
1495)2145(1                           65)2795(43
     1495                                260
     ————                               ————
      650)1495(2                         195
          1300                           195
          ————                           ————
           195)650(3        ∴ 65 is the G.C.M. required
               585
               ————
                65)195(3
                   195
                   ———
```

G.C.M. of 1495 and 2145 = 65

(2)... $5\frac{7}{9} + 7\frac{7}{12} + 9\frac{7}{15} = 21 + \frac{7}{9} + \frac{7}{12} + \frac{7}{15}$

$$= 21 + \frac{140 + 105 + 84}{180}$$

$$= 21 + \frac{329}{180}$$

$$= 21 + 1\frac{149}{180}$$

$$= 22\frac{149}{180} \;;$$

$$9\frac{9}{10} - 7\frac{3}{8} = 9\frac{36}{40} - 7\frac{15}{40} = 2\frac{21}{40}$$

(3)... $(\frac{10}{11} \text{ of } \frac{15}{16} \text{ of } 2\frac{2}{7}) \times (\frac{7}{8} \text{ of } \frac{5}{9} \text{ of } 4\frac{2}{5})$

$$= \frac{\cancel{10}^{5}}{\cancel{11}} \times \frac{\cancel{15}^{5}}{\cancel{16}} \times \frac{\cancel{16}}{7} \times \frac{7}{\cancel{8}} \times \frac{\cancel{5}}{\cancel{9}} \times \frac{\cancel{22}^{\cancel{2}}}{\cancel{5}} = \frac{25}{6} = 4\frac{1}{6} \;;$$

$(\frac{4}{7} \text{ of } \frac{5}{9} \text{ of } 18) \div (\frac{1}{3} \text{ of } \frac{10}{11} \text{ of } 2\frac{2}{7})$

$$= \frac{4}{7} \times \frac{\cancel{5}}{\cancel{9}} \times \frac{\cancel{18}^{\cancel{2}}}{1} \times \frac{3}{1} \times \frac{11}{\cancel{10}} \times \frac{7}{\cancel{16}} = \frac{33}{4} = 8\frac{1}{4}$$

(4)...
$$14s.\ 10\tfrac{1}{2}d. = 357 \text{ halfpence}$$
$$1 \text{ guinea} = 504 \quad \text{,,}$$
$$\tfrac{357}{504} = \tfrac{17}{24} \text{ of a guinea}$$

$$\frac{39}{64}\text{ sov.} = \frac{39}{\underset{16}{64}} \times \frac{\overset{5}{20}}{1} = \frac{\overset{s.}{195}}{16} = \overset{s.}{12}\ \ \overset{d.}{2\tfrac{1}{4}}$$

(5)...
$$\frac{11}{48}\text{ week} = \frac{11}{\underset{2}{48}} \times \frac{7}{1} \times \frac{\overset{\text{hrs.}}{24}}{1} = \frac{\overset{\text{hrs.}}{77}}{2} = \overset{\text{hrs.}}{38}\ \ \overset{\text{min.}}{30}$$

$$\frac{29}{36}\text{ day} = \frac{29}{\underset{3}{36}} \times \frac{\overset{2}{24}}{1} = \frac{58}{3} = \begin{array}{c} 19\ \ 20 \\ \hline \text{hrs. } 19\ \ 10 \text{ min.} \end{array}$$

(6)... See *"Answers."*

(7)... See *"Answers."*

```
32)23·00000(·71875
   22 4
   ───
     60
     32
   ───
    280
    256
   ───
    240
    224
   ───
    160
    160
   ───
```

$$80\begin{cases} 8)47 \\ \overline{10)5\cdot8750} \end{cases}$$
$$\overline{\cdot5875}$$
$$\therefore \tfrac{47}{80} = \cdot5875$$

Or thus :—

$$32\begin{cases} 4)23 \\ \overline{8)5\cdot75000} \end{cases}$$
$$\overline{\cdot71875}$$

$$\therefore \tfrac{23}{32} = \cdot71875$$

$$125\begin{cases} 5)69 \\ 5)\overline{13\cdot80} \\ 5)\overline{2\cdot760} \end{cases}$$
$$\overline{\cdot552}$$

$$\therefore \tfrac{69}{125} = \cdot552$$

(8)... $\cdot15 = \frac{15}{100} = \frac{3}{20}$; $\cdot235 = \frac{235}{1000} = \frac{47}{200}$; $\cdot045 = \frac{45}{1000} = \frac{9}{200}$;

$\cdot1875 = \frac{1875}{10000} = \frac{3}{16}$; $\cdot0036 = \frac{36}{10000} = \frac{9}{2500}$

(9)... $\cdot009 \times 10 = \frac{9}{1000} \times 10 = \frac{9}{100} = \cdot09$,

$\cdot009 \times 100 = \frac{9}{1000} \times 100 = \frac{9}{10} = \cdot9$,

$\cdot009 \times 1000 = \frac{9}{1000} \times 1000 = 9$;

$\cdot23 \div 10 = \frac{23}{100} \times \frac{1}{10} = \frac{23}{1000} = \cdot023$,

$\cdot23 \div 100 = \frac{23}{100} \times \frac{1}{100} = \frac{23}{10000} = \cdot0023$,

$\cdot23 \div 1000 = \frac{23}{100} \times \frac{1}{1000} = \frac{23}{0} = \cdot00023$

(10)... See "*Answers.*"

EXERCISE LXII.

(1)...
       hrs. min.   hrs. min.   hrs. min.

From 8   6 A.M. to 3   51 P.M. = 7   45

                                    60

                                465 minutes

(2)...
            lb.

            112

             $2\frac{1}{2}$

           224

            56

       12)280

            23   4 selling price per cwt.

            17   9 cost price per cwt.

             5   7 profit on 1 cwt.

                $6\frac{1}{2}$

         1 13   6

           2   $9\frac{1}{2}$

       £1 16 $3\frac{1}{2}$ profit on $6\frac{1}{2}$ cwt.

(3)... $7\frac{2}{9} \times 6\frac{3}{4} \times \frac{9}{13} \times \frac{4}{5} \times \frac{2}{7} \times 1\frac{5}{9} \times \frac{15}{16} \times \frac{8}{9}$

$$= \frac{\cancel{65}^{5}}{9} \times \frac{\cancel{27}^{3}}{\cancel{4}} \times \frac{9}{\cancel{13}} \times \frac{\cancel{4}}{5} \times \frac{2}{7} \times \frac{\cancel{14}^{2}}{9} \times \frac{\cancel{15}^{3}}{\cancel{16}_{2}} \times \frac{8}{9}$$

$$= 10$$

(4)... $\dfrac{13}{18}$ gui. $= \dfrac{13}{\cancel{18}} \times \dfrac{\overset{14}{\cancel{252}}}{1} = 182$ pence

$£1$ $13s.$ $10d. = 406$ pence

$$\tfrac{182}{406} \div \tfrac{14}{14} = \tfrac{13}{29}$$

(5)... 4 days 16 hours 30 minutes $= 6750$ minutes

1 week $= 10080$ minutes

$$\tfrac{6750}{10080} \div \tfrac{90}{90} = \tfrac{75}{112} \text{ of a week}$$

(6)...

7·35	
19·006	
·525	150
·1075	40·32975
13·34125	109·67025
40·32975	

(7)...

```
  726·305          405·26)15168·8818(37·43
   19·216                 12157 8
 ─────────               ────────
 4357830                  301108
  726305                  283682
 1452610                 ───────
 6536745                  174261
  726305                  162104
───────────              ───────
13956·676880              121578
                          121578
                         ────────
```

(8)...

$$£ \quad s. \quad d.$$
$$5 \quad 10 \quad 0 \text{ per cwt.}$$
$$4 \times 4 + 1 = 17$$

$$\overline{22 \quad 0 \quad 0}$$
$$4$$

		£	s.	d.
		88	0	0
2 qrs. $= \frac{1}{2}$ of 1 cwt.		5	10	0
14 lb. $= \frac{1}{4}$ „ 2 qrs.		2	15	0
7 lb. $= \frac{1}{2}$ „ 14 lb.		0	13	9
3½ lb. $= \frac{1}{2}$ „ 7 lb.		0	6	10½
		0	3	5¼

$$£97 \quad 9 \quad 0\tfrac{3}{4}$$

$$£ \quad s. \quad d.$$
$$2 \quad 18 \quad 0 \text{ per quarter}$$
$$4 \times 7 + 1 = 29$$

$$\overline{11 \quad 12 \quad 0}$$
$$7$$

		£	s.	d.
		81	4	0
4 bu. $= \frac{1}{2}$ of 1 qr.		2	18	0
2 bu. $= \frac{1}{2}$ „ 4 bu.		1	9	0
1 bu. $= \frac{1}{2}$ „ 2 bu.		0	14	6
1 pk. $= \frac{1}{4}$ „ 1 bu.		0	7	3
		0	1	9¾

$$£86 \quad 14 \quad 6\tfrac{3}{4}$$

$$£ \quad s. \quad d.$$
$$84 \text{ gui.} = 88 \quad 4 \quad 0 \text{ per acre}$$
$$4 \times 4 + 1 = 17$$

$$\overline{352 \quad 16 \quad 0}$$
$$4$$

		£	s.	d.
		1411	4	0
2 ro. $= \frac{1}{2}$ of 1 ac.		88	4	0
1 ro. $= \frac{1}{2}$ „ 2 ro.		44	2	0
20 per. $= \frac{1}{2}$ „ 1 ro.		22	1	0
2½ per. $= \frac{1}{8}$ „ 20 per.		11	0	6
		1	7	6¾

$$£1577 \quad 19 \quad 0\tfrac{3}{4}$$

$$(9)\dots \quad \overset{\text{per. da.}}{5\times 8} \quad : \quad \overset{\text{per. da.}}{6\times x} \quad :: \quad \overset{\text{gal.}}{7\tfrac{1}{2}} \quad : \quad \overset{\text{bar.}}{2} = \overset{\text{gal.}}{72}$$

$$\frac{2}{15} \qquad \frac{2}{144}$$

$$x = \frac{\cancel{5}\times 8\times \cancel{144}\,\overset{\overset{8}{\cancel{24}}}{}}{\cancel{6}\times \cancel{15}\,\underset{3}{}} = 64 \text{ days}$$

$$\begin{array}{l} \qquad\qquad\qquad\qquad \overset{\text{min. sec.}}{} \\ \text{one gains } 4 \quad 35 \text{ in 24 hours} \\ \text{the other loses } 3 \quad 45 \text{ in 24 hours} \\ \therefore \text{ there is a difference of } \overline{8 \quad 20} \text{ in 24 hours} \end{array}$$

From Saturday, 6 P.M. to Tuesday, noon = 66 hours

$$\overset{\text{hrs.}}{\underset{4}{\cancel{24}}} \quad : \quad \overset{\text{hrs.}}{\underset{11}{\cancel{66}}} \quad :: \quad \overset{\text{min. sec.}}{8 \quad 20} \atop 11$$

$$4\,\overline{)91 \quad 40}$$

$$\text{min. } 22 \quad 55 \text{ sec.}$$

EXERCISE LXIII.

$$(1)\dots \quad \overset{\text{hrs. min.}}{\text{From } 3 \ 44} \text{ A.M. to } \overset{\text{hrs. min.}}{8 \ 18} \text{ P.M.} = \overset{\text{hrs. min.}}{16 \ 34}$$

$$\frac{60}{994} \text{ minutes}$$

(2)...   4000 tons = 80,000 cwt.

$$\begin{array}{ll} \overset{s.\quad d.}{10\ 0} = \tfrac{1}{2} \text{ of } \pounds 1 & \overset{\pounds}{80000} = \text{value at } \pounds 1 \text{ per cwt.} \\ \quad 6 = \tfrac{1}{20} \text{ ,, } 10s. & \overline{40000} \\ \quad 3 = \tfrac{1}{2} \text{ ,, } 6d. & 2000 \\ & \underline{1000} \\ & \pounds 43000 \end{array}$$

(3)...

$$357)425(1$$
$$357$$
$$68)357(5 \qquad \text{G.C.M.} = 17$$
$$340$$
$$17)68(4$$
$$68$$

$$391)667(1 \qquad\qquad 23)713(31$$
$$391 \qquad\qquad\qquad 69$$
$$276)391(1 \qquad\qquad 23$$
$$276 \qquad\qquad\qquad 23$$
$$115)276(2$$
$$230 \qquad \text{G.C.M. required 23}$$
$$46)115(2$$
$$92$$
$$23)46(2$$
$$46$$

G.C.M. of 391 and 667 = 23

(4)...

$$2)3\ \ 7\ \ 9\ \ 14\ \ 15\ \ 36\ \ 63$$
$$3)\overline{3\ \ 7\ \ 9\ \ \ 7\ \ 15\ \ 18\ \ 63}$$
$$3)\overline{1\ \ 7\ \ 3\ \ \ 7\ \ \ 5\ \ \ 6\ \ 21}$$
$$7)\overline{1\ \ 7\ \ 1\ \ \ 7\ \ \ 5\ \ \ 2\ \ \ 7}$$
$$\overline{1\ \ 1\ \ 1\ \ \ 1\ \ \ 5\ \ \ 2\ \ \ 1}$$

L.C.M. $= 2 \times 3 \times 3 \times 7 \times 5 \times 2 = 1260$

(5)...

$$1\tfrac{3}{5}+2\tfrac{4}{9}+3\tfrac{5}{7} = 6+\tfrac{3}{5}+\tfrac{4}{9}+\tfrac{5}{7}$$
$$= 6+\frac{189+140+225}{315}$$
$$= 6+1\tfrac{239}{315}$$
$$= 7\tfrac{239}{315};$$

$$7\tfrac{2}{9}-3\tfrac{7}{12} = 7\tfrac{8}{36}-3\tfrac{21}{36} = 3\tfrac{23}{36}$$

$(6)\ldots$

$$\frac{5}{12}\times 3\tfrac{3}{4}\times 7\times 2\tfrac{2}{15} = \frac{5}{\cancel{12}}\times\frac{\cancel{15}}{\cancel{4}}\times\frac{7}{1}\times\frac{\overset{2}{\cancel{\overset{8}{\cancel{32}}}}}{\cancel{15}}$$

$$= \frac{70}{3} = 23\tfrac{1}{3};$$

$$5\tfrac{7}{16} \div 3\tfrac{5}{8} = \frac{\overset{3}{\cancel{87}}}{\underset{2}{\cancel{16}}}\times\frac{\cancel{8}}{\cancel{29}} = \frac{3}{2} = 1\tfrac{1}{2}$$

$(7)\ldots$

$$11s.\ 10\tfrac{1}{2}d. = 285 \text{ halfpence}$$
$$1 \text{ sovereign} = 480 \qquad ,,$$
$$\tfrac{285}{480} \div \tfrac{15}{15} = \tfrac{19}{32} \text{ of a sovereign}$$

$$9s.\ 7\tfrac{1}{2}d. = 231 \text{ halfpence}$$
$$1 \text{ guinea} = 504 \text{ halfpence}$$
$$\tfrac{231}{504} \div \tfrac{21}{21} = \tfrac{11}{24} \text{ of a guinea}$$

$(8)\ldots$

$$\frac{11}{24}\text{ gui.} = \frac{11}{\underset{8}{\cancel{24}}}\times\frac{\overset{7}{\cancel{21}}}{1} = \frac{77}{8} = \overset{\pounds}{0}\ \overset{s.}{9}\ \overset{d.}{7\tfrac{1}{2}}$$

$$\frac{19}{32}\text{ sov.} = \frac{19}{\underset{8}{\cancel{32}}}\times\frac{\overset{5}{\cancel{20}}}{1} = \frac{95}{8} = 0\ 11\ 10\tfrac{1}{2}$$

$$\frac{17}{24}\text{ cro.} = \frac{17}{24}\times\frac{5}{1} = \frac{85}{24} = 0\ 3\ 6\tfrac{1}{2}$$

$$\frac{11}{16}s. = \frac{11}{\underset{4}{\cancel{16}}}\times\frac{\overset{3}{\cancel{12}}}{1}d. = \frac{33}{4}d. = 0\ 0\ 8\tfrac{1}{4}$$

$$\overline{\pounds1\ 5\ 8\tfrac{3}{4}}$$

$(9)\ldots$

	s.	d.	£	s.	d.
3½ yds. Longcloth	1	1 =	0	3	9½
¾ yd. Irish Linen	3	6 =	0	1	3¾
8 Buttons		=	0	0	4
Making		=	0	2	9
Cost of each shirt		=	0	8	2¼
					12
Cost of a dozen shirts		=	£4	18	3

(10)...   1 woman can do $\frac{7}{10}$ of the work of a man

∴ 5 women can do $(\frac{7}{10} \times 5 =)$ $3\frac{1}{2}$ times the work of a man

$$7 + 3\frac{1}{2} = \frac{10\frac{1}{2}}{3} \quad : \quad \frac{7}{2} \quad :: \quad \begin{array}{c} \text{da.} \\ 15 \\ 2 \end{array}$$

$$3)\overline{30}$$

$$\overline{10} \text{ days}$$

EXERCISE LXIV.

(1)...

	£	s.	d.
217 half-guineas...... =	113	18	6
149 half-crowns ...... =	18	12	6
437 sixpences......... =	10	18	6
519 halfpence......... =	1	1	7½
	£144	11	1½

(2)...   £1167   3s. $1\frac{1}{4}d.$ = 1120469 farthings

£19   15s. $7\frac{3}{4}d.$ = 18991 farthings

1120469 ÷ 18991 = 59

(3)...   3 yds. 3 qrs. 2 na. = 62 nails

$34\frac{1}{2}$ yds. + $43\frac{3}{4}$ yds. + $61\frac{1}{4}$ yds. = $139\frac{1}{2}$ yds. = 2232 nails

2232 ÷ 62 = 36 suits

(4)...

			s.	d.	£	s.	d.
$17\frac{3}{4}$ yds.	Silk Velvet......	7	6 =	6	13	1½
$29\frac{1}{4}$ „	Lutestring	3	9 =	5	9	8¼
$19\frac{1}{2}$ „	Flannel	1	5 =	1	7	7½
$26\frac{1}{4}$ „	Irish Linen......	1	8 =	2	3	9
				£15	14	2¼

(5)... $\dfrac{\frac{4}{9}}{\frac{7}{8}} = \dfrac{4 \times 8}{7 \times 9} = \dfrac{32}{63}$; $\dfrac{2\frac{3}{5}}{7} = \dfrac{\frac{13}{5}}{7} = \dfrac{13}{7 \times 5} = \dfrac{13}{35}$

$\dfrac{5}{8\frac{4}{5}} = \dfrac{\frac{5}{1}}{\frac{44}{5}} = \dfrac{5 \times 5}{44} = \dfrac{25}{44}$;

$\dfrac{4\frac{7}{10}}{8\frac{5}{12}} = \dfrac{\frac{47}{10}}{\frac{101}{12}} = \dfrac{47 \times 12}{101 \times 10} = \dfrac{564}{1010} = \dfrac{282}{505}$

(6)...

$$40 \begin{cases} \overline{10)29} \\ 4)\overline{2{\cdot}9} \\ \hline {\cdot}725 \end{cases}$$

$$50 \begin{cases} \overline{10)37} \\ 5)\overline{3{\cdot}7} \\ \hline {\cdot}74 \end{cases}$$

$$80 \begin{cases} \overline{10)61} \\ 8)\overline{6{\cdot}1} \\ \hline {\cdot}7625 \end{cases}$$

$$250 \begin{cases} \overline{10)137} \\ 5)\overline{13{\cdot}7} \\ 5)\overline{2{\cdot}74} \\ \hline {\cdot}548 \end{cases}$$

(7)...

$$\cdot076)6{\cdot}08380(80{\cdot}05$$
$$\underline{6\ 08}$$
$$\underline{380}$$
$$380$$

$$\cdot0075)\cdot94125(125{\cdot}5$$
$$\underline{75}$$
$$\overline{191}$$
$$\cdot\ 150$$
$$\overline{412}$$
$$375$$
$$\overline{375}$$
$$375$$

(8)...

$$4)\ 2$$
$$12)\ 7{\cdot}5$$
$$20)\overline{14{\cdot}625}$$
14s. 7½d. = ‾‾‾·73125 of sov.

gui.
$$\cdot5625 = 11s\ 9\tfrac{3}{4}d.$$
$$\underline{21}$$
$$\overline{11{\cdot}8125}s.$$
$$\underline{12}$$
$$9{\cdot}7500d.$$
$$\underline{4}$$
$$3{\cdot}0000\ \text{far.}$$

(9)...

E. ells		yds.		£	s.		
8⅘	:	19¾	::	1	2	:	x
5		4		20			
44		79		22			

$$x = \frac{79 \times \cancel{22}}{\cancel{44}_2} = \frac{79}{2}s. = £1\ 19s.\ 6d.$$

(10)...

$$\tfrac{3}{4} \text{ peck} \times 365 = 273\tfrac{3}{4} \text{ pecks}$$

$$1 \text{ quarter} = 32 \text{ pecks}$$

pks.		pks.		s.		
32	:	273¾	::	32	:	x
4		4				
128		1095				

$$x = \frac{1095 \times \cancel{32}}{\underset{4}{\cancel{128}}} = \frac{1095}{4} = \text{£13 13}s.\text{ 9}d.$$

$$\tfrac{1}{3} \text{ truss} \times 365 = 121\tfrac{2}{3} \text{ trusses}$$

tr.		tr.		£	s.		
36	:	121⅔	::	4	4	:	x
3		3		20			
108		365		84			

$$x = \frac{365 \times \overset{7}{\cancel{84}}}{\underset{9}{\cancel{108}}} = \frac{2555}{9}s. = \text{£14 3}s.\text{ 10}\tfrac{2}{3}d.$$

	£	s.	d.
Cost of oats	13	13	9
„ hay	14	3	10⅔
	£27	17	7⅔

EXERCISE LXV.

(1)...

sq.yds.	sq.ft.	sq.in.
29	6	117
34	8	93
17	5	123
55	7	79
138	1	124

sq. yds

Proof.

(2)...

$$596347$$
$$4$$

ac.	po.	yds.
123	33	$28\frac{3}{4}$

$$\begin{matrix} \text{yds.} \\ 30\frac{1}{4} \end{matrix} = \begin{matrix} \text{qrs.} \\ 121 \end{matrix} \left\{ \begin{matrix} 11)\overline{2385388} \\ 11)\overline{216853}\;\;5 \\ 40)\overline{19713}\;\;10 \end{matrix} \right\} \begin{matrix} \text{qrs.} & \text{yds.} \\ 115 = 28\frac{3}{4} \end{matrix}$$

$$4)\overline{492\;\;33} \text{ poles}$$
$$\overline{123} \text{ acres}$$

4

$$\overline{492}$$

40

$$\overline{19713}$$

$$30\frac{1}{4}$$

$$\overline{591418\frac{3}{4}}$$

$$4928\frac{1}{4}$$

$$\overline{596347} \text{ sq. yds.}$$

Ans. 123 ac. 33 po. $28\frac{3}{4}$ sq. yds.

(3)...

$$\begin{matrix} & & & d. & \pounds & s. & d. \\ 71\frac{3}{4} \text{ lb. Coffee at } 16 & = & 4 & 15 & 8 \\ & \text{cost} & = & 3 & 18 & 9 \\ & \text{profit} & = & & \overline{16} & \overline{11} \end{matrix}$$

(4)...

$$\begin{matrix} \text{yds.} & & \text{yds.} & & \pounds & s. & d. \\ 17\frac{3}{4} & : & 19\frac{1}{2} & :: & 9 & 3 & 5 & : & x \\ 4 & & 4 & & 20 \\ \overline{71} & & \overline{78} & & \overline{183} \\ & & & & 12 \\ & & & & \overline{2201} \end{matrix}$$

$$x = \frac{78 \times \overset{31}{\cancel{2201}}}{\cancel{71}} = 2418d. = \pounds10 \; 1s. \; 6d.$$

$$\begin{matrix} \text{yds.} & & \text{yds.} & & d. \\ 17\frac{3}{4} & : & 23\frac{1}{4} & :: & 2201 & : & x \\ 4 & & 4 \\ \overline{71} & & \overline{93} \end{matrix}$$

$$x = \frac{93 \times \overset{31}{\cancel{2201}}}{\cancel{71}} = 2883d. = \pounds12 \; 0s. \; 3d.$$

(5)...

1. $$\frac{4\frac{3}{4} + 5\frac{2}{9}}{7\frac{5}{6} - 3\frac{7}{8}} = \frac{4\frac{27}{36} + 5\frac{8}{36}}{7\frac{20}{24} - 3\frac{21}{24}} = \frac{9\frac{35}{36}}{3\frac{23}{24}} = \frac{\frac{359}{36}}{\frac{95}{24}}$$

$$= \frac{359 \times \overset{2}{\cancel{24}}}{94 \times \underset{3}{\cancel{36}}} = \frac{718}{285} = 2\frac{148}{285};$$

2. $\dfrac{8\frac{4}{5}+3\frac{3}{10}}{5\frac{1}{4}\times 2\frac{2}{7}} = \dfrac{\frac{44}{5}\times\frac{10}{33}}{\frac{21}{4}\times\frac{16}{7}} = \dfrac{\frac{8}{3}}{12} = \dfrac{8}{36} = \dfrac{2}{9}$;

3. $\dfrac{10\frac{2}{7}-5\frac{3}{8}}{1\frac{1}{4}\text{ of }6\frac{1}{4}} = \dfrac{10\frac{16}{56}-5\frac{21}{56}}{1\frac{1}{4}\times\frac{25}{4}} = \dfrac{4\frac{51}{56}}{\frac{275}{56}} = \dfrac{275}{275} = 1$

(6)...

$$13 \text{ cwt. } 2 \text{ qrs. } 21 \text{ lb. } = 1533 \text{ lb.}$$
$$1 \text{ ton } = 2240 \text{ lb.}$$

$$\tfrac{1533}{2240}\div 7 = \tfrac{219}{320}\text{ of a ton}$$

$$1 \text{ qr. } 24\tfrac{1}{2} \text{ lb. } = 105 \text{ half-pounds}$$
$$1 \text{ cwt } = 224 \quad\text{,,}$$

$$\tfrac{105}{224}\div 7 = \tfrac{15}{32}\text{ of a cwt.}$$

(7)... $\cdot 1875 = \tfrac{1875}{10000} = \tfrac{3}{16}$; $\cdot 096 = \tfrac{96}{1000} = \tfrac{12}{125}$

(8)...

$$\frac{5}{16}+\frac{2}{15} = \frac{75+32}{240} = \frac{107}{240}$$

$$\tfrac{1}{12} \quad : \quad \tfrac{107}{240} \quad :: \quad \overset{s.}{10} \quad : \quad x$$

$$x = \frac{12}{1}\times\frac{107}{240}\times\frac{10}{1} = \frac{107}{2}\,s. = \text{\pounds}2\ 13s.\ 6d.$$

(9)...

men	da.	hrs.		men	da.	hrs.		\pounds	s.		\pounds
8	× 7 ×	10½	:	10	× x ×	9	::	14	14	:	27
		2				2			20		20
		21				18			294		540

$$x = \frac{8\times 7\times 21\times 540}{10\times 18\times 294} = 12 \text{ days}$$

(10)...At the end of 1 hour, they are $6\frac{3}{4} + 7\frac{1}{2} = 14\frac{1}{4}$ nearer to each other than at the commencement:

$\therefore$ they will meet in $(70 \div 14\frac{1}{4} = \frac{70}{1} \times \frac{4}{57} = \frac{280}{57} =)4\frac{52}{57}$ hours

A will have travelled $(6\frac{3}{4} \times 4\frac{52}{57} = \frac{27}{4} \times \frac{280}{57} = \frac{630}{19} =)33\frac{3}{19}$ miles

B   „   „ $(7\frac{1}{2} \times 4\frac{52}{57} = \frac{15}{2} \times \frac{280}{57} = \frac{700}{19} =)36\frac{16}{19}$ miles

EXERCISE LXVI.

(1)...

			s.	d.		£	s.	d.
$17\frac{1}{2}$ lb.	Black tea.........	4	4	=	3	15	10
$2\frac{3}{4}$ „	Green tea	5	4	=		14	8
$8\frac{1}{3}$ „	Coffee	1	8	=		14	2
$4\frac{1}{2}$ „	Cocoa	1	6	=		6	9
21 „	Raw sugar		$4\frac{1}{2}$	=		7	$10\frac{1}{2}$
15 „	Refined sugar ...		$6\frac{1}{4}$	=		8	$1\frac{1}{2}$
					£6	7	5

(2)...

1 acre = 4840 sq. yds.

$15\frac{3}{4}$

24200
4840
3630

yds.
$\frac{1}{4}$ mile = 440)76230(173$\frac{1}{4}$ yards
440

3223
3080

1430
1320

110
$\frac{110}{440} = \frac{1}{4}$

(3)...

hrs.		hrs.		da.	
$8\frac{1}{2}$	:	13	::	$5\frac{1}{2}$	: x

$x = \frac{2}{17} \times \frac{13}{1} \times \frac{11}{2} = \frac{143}{17}$ da. $= 8\frac{7}{17}$ da. $= 8$ da. $3\frac{1}{2}$ hrs.

K

(4)...
$$8\tfrac{11}{15} - 5\tfrac{4}{9} = 8\tfrac{33}{45} - 5\tfrac{20}{45} = 3\tfrac{13}{45};$$

$$15\tfrac{5}{9} \div 5\tfrac{3}{5} = \frac{\cancel{140}}{9} \times \frac{5}{\cancel{28}} = \frac{25}{9} = 2\tfrac{7}{9}$$

(5)...
$$1\tfrac{1}{8}, \; 1\tfrac{7}{25}, \; 3\tfrac{1}{2} = \frac{4400}{7200}, \; \frac{4896}{7200}, \; \frac{4725}{7200}$$

$\frac{4896}{7200}$, corresponding to $\tfrac{17}{25}$, is the greatest

(6)...
$$\frac{13\tfrac{3}{4}}{24\tfrac{3}{4}} = \frac{55/4}{99/4} = \frac{55}{99} = \frac{5}{9}$$

```
         £   s.   d.
      9)7  15    3
        -----------
          17     3
                 5
        -----------
        £4    6    3
```

(7)...   19 weeks, 4 days, 12 hours = 3300 hours
365 days, 6 hours = 8766 hours
$$\frac{3300}{8766} \div \frac{6}{6} = \frac{550}{1461}$$

(8)...   1. $(19.205 - 7.65) \div .3125$
$= 11.555 \div .3125$
$= 36.976$

2. $(26.5 \times 6.75 \times .025) \div 1.875$
$= 4.471875 \div 1.875$
$= 2.385$

3. $(1.375 \div .0625) \times (16.3 - 11.65)$
$= 22 \times 4.65$
$= 102.3$

(9)...
```
                                    cwt.
     4) 3                .265625 = 1 qr. 1 lb. 12 oz.
    12) 0.75                          4
    21)17.0625              qr. 1.062500
17s. 0¾d. =    .8125 of a gui.        28
                           lb. 1.750000
                                     16
                           oz. 12.000000
```

$$
\begin{array}{ccccccc}
\text{yds.} & & \text{yds.} & & \pounds \\
(10)\dots & 13\cdot6875 & : & 47\cdot025 & :: & 9\cdot125 & : & x
\end{array}
$$

$$
x = \frac{47\cdot025 \times 9\cdot125}{13\cdot6875} = \pounds 31\cdot35 = \pounds 31\ 7s.
$$

EXERCISE LXVII.

$$
\begin{array}{l}
\text{lb.} \\
(1)\dots \qquad 1505280 \\
\qquad\qquad\quad 16 \\
9797760)\overline{24084480}(2\ oz.\ 7\tfrac{2+1}{7\cdot3\cdot0}\ drs. \\
\qquad\quad 19595520 \\
\qquad\quad \overline{4488960} \\
\qquad\qquad\qquad 16 \\
9797760)\overline{71823360}(7\ drs. \\
\qquad\quad 68584320 \\
\qquad\quad \overline{3239040} = \dfrac{241}{729} \\
\qquad\quad \overline{9797760}
\end{array}
$$

$$
\begin{array}{ll}
\text{lb.} & \text{lb.} \\
(2)\dots \quad 15\tfrac{1}{4} & \qquad 68\tfrac{1}{2} \\
\qquad\quad 14\tfrac{1}{2} & \qquad\ 6\tfrac{1}{2}\ \text{per lb.} \\
\qquad\quad 13\tfrac{1}{2} & \qquad \overline{411} \\
\qquad\quad 13 & \qquad\ 34\tfrac{1}{4} \\
\qquad\quad 12 & \ 12)\overline{445\tfrac{1}{4}} \\
\qquad\quad \overline{68\tfrac{1}{2}} & \ 20)\overline{37\ \ 1\tfrac{1}{4}} \\
& \qquad \overline{\pounds1\ 17s.\ 1\tfrac{1}{4}d.}
\end{array}
$$

$$
\begin{array}{ll}
\begin{array}{rl}
s. & d. \\
(3)\dots\quad 10 & 0 = \tfrac{1}{2}\ \text{of}\ \pounds1 \\
1 & 3 = \tfrac{1}{8}\ \text{of}\ 10s. \\
& 6 = \tfrac{1}{20}\ \text{of}\ 10s. \\
& \tfrac{3}{4} = \tfrac{1}{8}\ \text{of}\ 6d.
\end{array}
&
\begin{array}{l}
\pounds\quad s.\quad d. \\
737\quad 0\quad 0 = \text{value at } \pounds1 \text{ per yd.} \\
\overline{368\quad 10\quad 0} \\
46\quad 1\quad 3 \\
18\quad 8\quad 6 \\
2\quad 6\quad 0\tfrac{3}{4} \\
\overline{\pounds435\quad 5\quad 9\tfrac{3}{4}}
\end{array}
\end{array}
$$

$$
\begin{array}{l}
\text{2 qrs.} = \tfrac{1}{2} \text{ of 1 cwt.} \\
\\
\text{14 lb.} = \tfrac{1}{4} \text{ of 2 qrs.} \\
\text{3}\tfrac{1}{2} \text{ lb.} = \tfrac{1}{4} \text{ of 14 lb.}
\end{array}
\quad
\begin{array}{rrr}
£ & s. & d. \\
7 & 10 & 0 \text{ per cwt.} \\
& & 7 \\
\hline
52 & 10 & 0 \\
3 & 15 & 0 \\
0 & 18 & 9 \\
0 & 4 & 8\tfrac{1}{4} \\
\hline
£57 & 8 & 5\tfrac{1}{4}
\end{array}
$$

$$
\begin{array}{l}
\text{2 bu.} = \tfrac{1}{4} \text{ of 1 qr.} \\
\\
\text{1 bu.} = \tfrac{1}{2} \text{ of 2 bu.} \\
\text{2 pks.} = \tfrac{1}{2} \text{ of 1 bu.}
\end{array}
\quad
\begin{array}{rrr}
£ & s. & d. \\
1 & 6 & 0 \text{ per quarter} \\
& & 5 \\
\hline
6 & 10 & 0 \\
0 & 6 & 6 \\
0 & 3 & 3 \\
0 & 1 & 7\tfrac{1}{2} \\
\hline
£7 & 1 & 4\tfrac{1}{2}
\end{array}
$$

(4)...
$$
\begin{array}{r}
s. \quad d. \\
7)\overline{16 \quad 7\tfrac{1}{2}} \\
2 \quad 4\tfrac{1}{2} \\
5 \\
\hline
11s. \ 10\tfrac{1}{2}d.
\end{array}
\qquad
\begin{array}{r}
£ \quad s. \quad d. \\
9)\overline{1 \quad 10 \quad 11\tfrac{1}{4}} \\
3 \quad 5\tfrac{1}{4} \\
2 \\
\hline
6s. \ 10\tfrac{1}{2}d.
\end{array}
\qquad
\begin{array}{r}
£ \quad s. \quad d. \\
12)\overline{3 \quad 8 \quad 9} \\
5 \quad 8\tfrac{3}{4} \\
7 \\
\hline
£2 \quad 0 \quad 1\tfrac{1}{4}
\end{array}
$$

$$
\begin{array}{l}
\tfrac{5}{7} \text{ of } \ 0 \ \ 16 \ \ 7\tfrac{1}{2} = 0 \ \ 11 \ \ 10\tfrac{1}{2} \\
\tfrac{2}{9} \text{ of } \ 1 \ \ 10 \ \ 11\tfrac{1}{4} = 0 \ \ 6 \ \ 10\tfrac{1}{2} \\
\tfrac{7}{12} \text{ of } \ 3 \ \ 8 \ \ 9 \ \ \ = 2 \ \ 0 \ \ 1\tfrac{1}{4} \\
\hline
£2 \ \ 18 \ \ 10\tfrac{1}{4}
\end{array}
$$

(5)...   5 oz. 17 dwts. 18 grs. = 2826 grains

1 lb. = 5760 grains

$$\tfrac{2826}{5760} \div \tfrac{18}{18} = \tfrac{157}{320} \text{ of a lb. Troy}$$

(6)...   A can reap $\tfrac{2}{21}$ of an acre in 1 hour

B   „ $\tfrac{1}{12}$ „   „

C   „ $\tfrac{2}{27}$ „   „

∴ A + B + C can reap $\left(\tfrac{2}{21} + \tfrac{1}{12} + \tfrac{2}{27}\right)$ acre in 1 hour

$$\frac{2}{21} + \frac{1}{12} + \frac{2}{27} = \frac{72 + 63 + 56}{756} = \frac{191}{756}$$

$$\frac{191}{756} \quad : \quad 5 \quad :: \quad 1 \quad : \quad x$$

with labels: ac. ac. hr.

$$x = \frac{756}{191} \times \frac{5}{1} = \frac{3780}{191} = 19\frac{151}{191} \text{ hours}$$

(7)...
$$\text{1.} \quad 271 \quad : \quad 383 \quad :: \quad 3523 \quad : \quad x$$

$$x = \frac{383 \times \overset{13}{\cancel{3523}}}{\cancel{271}} = 4979$$

$$\text{2.} \quad 64\frac{5}{8} \quad : \quad 26\frac{8}{9} \quad :: \quad 5\frac{7}{8} \quad : \quad x$$

$$x = \frac{\cancel{8}}{\underset{\cancel{11}}{\cancel{517}}} \times \frac{\overset{22}{\cancel{242}}}{9} \times \frac{47}{\cancel{8}} = \frac{22}{9} = 2\frac{4}{9}$$

$$\text{3.} \quad 2 \cdot 035 \quad : \quad 7 \cdot 613 \quad :: \quad 34 \cdot 595 \quad : \quad x$$

$$x = \frac{7 \cdot 613 \times \overset{17}{\cancel{34 \cdot 595}}}{\cancel{2 \cdot 035}} = 129 \cdot 421$$

(8)...
1 hf. cr. $+$ 2 fl. $+$ 3*s.* $=$ 9*s.* 6*d.* $=$ 19 sixpences

19 guineas $=$ 798 sixpences

$798 \div 19 = 42$

42 half-crowns

$42 \times 2 = 84$ florins

$42 \times 3 = 126$ shillings

(9)...

hrs. da.		hrs. da.		£	s.	d.		
5×49	:	11×25	::	18	7	6	:	x

$$8$$
$$\overline{147} \text{ hf. cr.}$$

$$x = \frac{11 \times \overset{5}{\cancel{25}} \times \overset{3}{\cancel{147}}}{\cancel{5} \times \cancel{49}} = 165 \text{ hf. cr.} = \text{£}20 \ 12s. \ 6d.$$

cattle mo.

(10)...

$$\begin{array}{lll} A & 25\times5 & =125 \\ B & 35\times3 & =105 \\ C & 45\times6 & =\underline{270} \\ & & \overline{500} \end{array}$$

$$500 \; : \; 125 \; :: \; \overset{\text{£ \; s.}}{12 \; 10} \; : \; \overset{\text{£ \; s. \; d.}}{3 \; 2 \; 6} \; A$$

$$500 \; : \; 105 \; :: \; \overset{\text{£ \; s.}}{12 \; 10} \; : \; \overset{\text{£ \; s. \; d.}}{2 \; 12 \; 6} \; B$$

$$500 \; : \; 270 \; :: \; \overset{\text{£ \; s.}}{12 \; 10} \; : \; \overset{\text{£ \; s. \; d.}}{6 \; 15 \; 0} \; C$$

EXERCISE LXVIII.

(1)... See "*Answers.*"

(2)...

$$\begin{array}{r} 333)414(1 \\ \underline{333} \\ 81)333(4 \\ \underline{324} \\ 9)81(9 \\ \underline{81} \end{array}$$

$$\begin{array}{r} 9)711(79 \\ \underline{63} \\ 81 \\ \underline{81} \end{array}$$

G.C.M. required = 9

G.C.M. of 333 and 414 = 9

$$\begin{array}{l} 2)7 \quad 9 \; 16 \; 21 \; 42 \; 56 \; 63 \\ \hline 2)7 \quad 9 \quad 8 \; 21 \; 21 \; 28 \; 63 \\ \hline 2)7 \quad 9 \quad 4 \; 21 \; 21 \; 14 \; 63 \\ \hline 3)7 \quad 9 \quad 2 \; 21 \; 21 \; 7 \; 63 \\ \hline 3)7 \quad 3 \quad 2 \quad 7 \quad 7 \quad 7 \; 21 \\ \hline 7)7 \quad 1 \quad 2 \quad 7 \quad 7 \quad 7 \quad 7 \\ \hline \quad 1 \quad 1 \quad 2 \quad 1 \quad 1 \quad 1 \quad 1 \end{array}$$

L.C.M. = $2\times2\times2\times3\times3\times7\times2$ = 1008

(3)...

$$3\tfrac{4}{7}+2\tfrac{2}{5}+5\tfrac{1}{4} = 10+\tfrac{4}{7}+\tfrac{2}{5}+\tfrac{1}{4}$$

$$= 10+\frac{80+56+35}{140}$$

$$= 10+\tfrac{171}{140}$$

$$= 10+1\tfrac{31}{140} = 11\tfrac{31}{140}$$

$$2\tfrac{7}{10}+6\tfrac{1}{2}+7\tfrac{3}{14} = 15+\tfrac{7}{10}+\tfrac{1}{2}+\tfrac{3}{14}$$

$$= 15+\frac{49+35+15}{70}$$

$$= 15+\tfrac{99}{70}$$

$$= 15+1\tfrac{29}{70} = 16\tfrac{29}{70}$$

$$16\tfrac{29}{70}-11\tfrac{31}{140} = 16\tfrac{58}{140}-11\tfrac{31}{140} = 5\tfrac{27}{140}$$

(4)...

$$\frac{2\tfrac{1}{5}}{7\tfrac{1}{3}} = \frac{\tfrac{11}{5}}{\tfrac{22}{3}} = \frac{\cancel{11}\times 3}{\underset{2}{\cancel{22}}\times 5} = \frac{3}{10}$$

$$3\tfrac{1}{4}\times\frac{8}{9}\times 6\tfrac{2}{13}\times\frac{3}{16}\times\frac{2\tfrac{1}{5}}{7\tfrac{1}{3}}$$

$$= \frac{\cancel{13}}{\cancel{4}}\times\frac{\overset{2}{\cancel{8}}}{\cancel{9}}\times\frac{\overset{5}{\cancel{80}}}{\cancel{13}}\times\frac{\cancel{3}}{\cancel{16}}\times\frac{\cancel{3}}{\cancel{10}} = 1$$

(5)...

$$\frac{11}{14}\text{ gui.} = \frac{11}{\underset{2}{\cancel{14}}}\times\frac{\overset{3}{\cancel{21}}}{1} = \frac{33}{2} = \begin{matrix}\pounds & s. & d. \\ 0 & 16 & 6\end{matrix}$$

$$\frac{7}{15}\text{ sov.} = \frac{7}{\underset{3}{\cancel{15}}}\times\frac{\overset{4}{\cancel{20}}}{1} = \frac{28}{3} = \begin{matrix}0 & 9 & 4\end{matrix}$$

$$\frac{13}{16}\text{ flo.} = \frac{13}{\underset{8}{\cancel{16}}}\times\frac{\cancel{2}}{1} = \frac{13}{8} = \begin{matrix}0 & 1 & 7\tfrac{1}{2} \\ \hline \pounds 1 & 7 & 5\tfrac{1}{2}\end{matrix}$$

$$(6)\ldots \overset{\cdot \text{ gui.}}{\cdot 5625} = 11s.\ 9\tfrac{3}{4}d.$$

$$\frac{21}{11\cdot8125s.}$$
$$\frac{12}{9\cdot7500d.}$$
$$\frac{4}{3\cdot0000f.}$$

$$\frac{17}{24}\text{ sov.} = \frac{17}{\cancel{24}}\times\frac{\overset{5}{\cancel{20}}}{1} = \frac{85}{6}s. = 14s.\ 2d.$$

$$14s.\ 2d. - 11s.\ 9\tfrac{3}{4}d. = 2s.\ 4\tfrac{1}{4}d.$$

			s.	d.	=	£	s.	d.
(7)... 12 doz.		Port	54	0	=	32	8	0
15	„	Sherry	45	0	=	33	15	0
6	„	Claret	66	0	=	19	16	0
6	„	Champagne	75	0	=	22	10	0
3	„	French Brandy	66	0	=	9	18	0
2	„	Jamaica Rum	38	0	=	3	16	0
4	„	Scotch Whiskey	37	6	=	7	10	0
3	„	Irish „	38	6	=	5	15	6
						£135	8	6

(8)...The trains are $(25+35 =)$ 60 miles nearer to each other at the end of an hour than they were at starting;

hence, they will meet in $(200\div60 =)$ 3 hrs. 20 min.

$$\begin{array}{cc}\text{hrs.} & \text{min.} \\ 10 & 30 \text{ A.M.} \\ 3 & 20 \\ \hline 1 & 50 \end{array}$$

∴ they will meet at 1h. 50m. P.M.

$$(9)\ldots$$
$$\underset{\overline{6\text{ gal.}}}{\overset{6d.}{}} \quad \overset{10d.}{\underset{\overline{4\text{ gal.}}}{\overset{16d.}{}}}$$

there must be 6 gallons of beer to every 4 gallons of ale.

$$4 \ :\ 6 \ ::\ 36 \ :\ 54 \text{ gallons of beer}$$

(10)...   £342 10s. + £453 + £624 10s. = £1420

£			£	s.			£	s.	d.			£	s.	d.	
1420	:	342	10	::	517	14	2	:	124	17	4¾	A.

£			£	s.			£	s.	d.			£	s.	d.	
1420	:	453	0	::	517	14	2	:	165	3	1½	B.

£			£	s.			£	s.	d.			£	s.	d.	
1420	:	624	10	::	517	14	2	:	227	13	7¾	C.

EXERCISE LXIX.

(1)...
s.	d.			£	s.	d.	
2	6	= ⅛ of £1		2379	0	0	= value at £1 each
1	0	= 1/20 of £1		297	7	6	
	1½	= ⅛ of 1s.		118	19	0	
				14	17	4½	
				£431	3	10½	

s.	d.			£	s.	d.	
10	0	= ½ of £1		3527	0	0	= value at £1 each
2	6	= ¼ of 10s.		1763	10	0	
1	3	= ½ of 2s. 6d.		440	17	6	
	2½	= ⅙ of 1s. 3d.		220	8	9	
				36	14	9½	
				£2461	11	0½	

(2)...   5 tons 13 cwt. 2 qrs. × 17 = 96 tons 9 cwt. 2 qrs.

	s.	d.	
	12	6	per ton
		8 × 12 = 96	
5	0	0	
		12	
60	0	0	
5 cwt. =		3	1½
4 cwt. =		2	6
2 qrs. =			3¾
£60	5	11¼	

(3)...

$$
\begin{array}{ccccccc}
\text{yds.} & & \text{yds.} & & \pounds & s. & d. \\
29\tfrac{3}{4} & : & 34\tfrac{1}{4} & :: & 15 & 12 & 4\tfrac{1}{2} & : & x \\
4 & & 4 & & & 20 \\
\hline
119 & & 137 & & & 312 \\
& & & & & 12 \\
\hline
& & & & & 3748 \\
& & & & & 4 \\
\hline
& & & & & 14994
\end{array}
$$

$$
x = \frac{137 \times \overset{126}{\cancel{14994}}}{\cancel{119}} = 17262 \text{ far.} = \pounds 17\ 19s.\ 7\tfrac{1}{2}d.
$$

(4)...

$$
\begin{array}{l}
2500 \text{ pamphlets} \\
\quad\quad 2\tfrac{1}{2} \\
\hline
5000 \\
1250 \\
\hline
24)\overline{6250} \text{ sheets} \\
\quad 20)\overline{260}\quad 10 \\
\hline
\text{reams } 13\quad 10 \text{ sheets}
\end{array}
$$

(5)...

$$
\begin{array}{l}
\quad\quad\quad \text{yds.} \\
\quad\quad\quad 237 \\
\tfrac{1}{4}\text{ mile} = \quad 440 \text{ yds.} \\
\hline
\quad\quad 9480 \\
\quad\quad 948 \\
\hline
104280 \text{ sq. yds.} \\
\quad\quad\quad 4
\end{array}
$$

$$
\begin{array}{l}
\text{yds.} \quad\quad \text{qrs.} \\
30\tfrac{1}{4} = 121 \left\{
\begin{array}{l}
11)\overline{417120} \\
11)\overline{37920} \\
\quad 40)\overline{3447}\quad 3 \\
\hline
\quad\quad 4)\overline{86}\quad 7 \text{ per.}
\end{array}
\right\} 33 \text{ qrs.} = 8\tfrac{1}{4} \text{ yds.} \\
\hline
\quad\quad\quad 21 \text{ ac. } 2 \text{ ro. } 7 \text{ per. } 8\tfrac{1}{4} \text{ yds.}
\end{array}
$$

(6)...

A can do $\tfrac{1}{12}$ in 1 hour

B „   „ $\tfrac{1}{10}$ „   „

C „   „ $\tfrac{1}{9}$ „   „

$\therefore$ A+B+C can do $\tfrac{1}{12} + \tfrac{1}{10} + \tfrac{1}{9}$ in 1 hour

$$
\frac{1}{12} + \frac{1}{10} + \frac{1}{9} = \frac{15+18+20}{180} = \frac{53}{180}
$$

$$
\tfrac{53}{180} : 1 :: 1 : 3\tfrac{21}{53} \text{ hours}
$$

(7)...
$$\frac{1}{6}+\frac{2}{9}+\frac{1}{4}+\frac{1}{6} = \frac{6+8+9+6}{36} = \frac{29}{36}$$

$$1-\tfrac{29}{36}=\tfrac{7}{36}$$

$$\overset{}{\tfrac{7}{36}} : 1 :: \overset{\text{boys}}{7} : \overset{\text{boys}}{36}$$

(8)...
$$15+3+2 = 20$$

$$112 \text{ lb.}\div 20 = 5\tfrac{3}{5} \text{ lb.}$$

$$5\tfrac{3}{5} \text{ lb.}\times 15 = 84 \text{ lb. of nitre}$$

$$5\tfrac{3}{5} \text{ lb.}\times 3 = 16\tfrac{4}{5} \text{ lb. of charcoal}$$

$$5\tfrac{3}{5} \text{ lb.}\times 2 = 11\tfrac{1}{5} \text{ lb. of sulphur}$$

(9)...
$$\overset{\text{hrs. da.}}{16\times 6} : \overset{\text{hrs. da.}}{25\times x} :: \overset{\text{bu.}}{9} : \overset{\text{bu.}}{56\tfrac{1}{4}}$$

$$\frac{4}{36} \qquad \frac{4}{225}$$

$$x = \frac{\cancel{16}^4\times 6\times \cancel{225}^9}{\cancel{25}\times \cancel{36}} = 24 \text{ days}$$

(10)...
$$\overset{\text{per. da.}}{8\times 5} : \overset{\text{per. da.}}{12\times x} :: \overset{\text{gal.}}{7\tfrac{1}{2}} : \overset{\text{gal.}}{36}$$

$$\frac{2}{15} \qquad \frac{2}{72}$$

$$x = \frac{8\times \cancel{5}\times \cancel{72}^2}{\cancel{12}\times \cancel{15}} = 16 \text{ days}$$

EXERCISE LXX.

(1)...

$$\tfrac{7}{10} = \cdot 7 \; ; \; \tfrac{5}{16} = \cdot 3125 \; ; \; \tfrac{13}{20} = \cdot 65 \; ;$$

$$\cdot 0275 = \tfrac{275}{10000} = \tfrac{11}{400} \; ; \; \cdot 624 = \tfrac{624}{1000} = \tfrac{78}{125}$$

$$\frac{7}{10} + \frac{11}{400} + \frac{5}{16} + \frac{78}{125} + \frac{13}{20} = \frac{1400 + 55 + 625 + 1248 + 1300}{2000}$$

$$= \tfrac{4628}{2000}$$

$$= 2\tfrac{628}{2000} = 2\tfrac{157}{500}$$

$$\begin{array}{r} \cdot 7 \\ \cdot 0275 \\ \cdot 3125 \\ \cdot 624 \\ \cdot 65 \\ \hline 2 \cdot 314 \end{array}$$

(2)...

$$\frac{4}{7} \text{ of } \frac{5}{11} \text{ of } 6\tfrac{3}{10} = \frac{\cancel{4}}{7} \times \frac{\cancel{5}}{11} \times \frac{\cancel{63}^{9}}{\cancel{10}_{2}} = \frac{18}{11}$$

$$\frac{4}{9} \text{ of } 5\tfrac{2}{5} = \frac{4}{\cancel{9}} \times \frac{\cancel{27}^{3}}{5} = \frac{12}{5}$$

$$\frac{12}{5} - \frac{18}{11} = \frac{132 - 90}{55} = \frac{42}{55} \; ;$$

$$17\tfrac{3}{5} \div (\tfrac{3}{5} \text{ of } 2\tfrac{3}{4}) = \frac{\cancel{88}^{8}}{\cancel{5}} \times \frac{\cancel{5}}{3} \times \frac{4}{\cancel{11}} = \frac{32}{3} = 10\tfrac{2}{3}$$

(3)...

cwt.	qrs.	lb.
7)4	2	0
	2	16
		5
3	0	24

cwt.	qrs.	lb.
16)7	3	12
	1	27
		11
5	1	17

cwt.	qr.	lb.
5	1	17
3	0	24
2	0	21

(4)... 　3 acres, 1 rood, 20 perches $=$ 16335 sq. yards

sq. yds.		sq. yds.		hrs.	
$1075\frac{5}{9}$	:	16335	::	$3\frac{1}{3}$	: x

$$x = \frac{\cancel{9}}{\cancel{9680}\atop\cancel{968}\atop 8} \times \frac{\overset{3}{\cancel{16335}}\overset{135}{}}{1} \times \frac{\cancel{10}}{\cancel{3}} = \frac{405}{8} \text{ hrs.} = 50\frac{5}{8} \text{ hours}$$

(5)...

$$
\begin{array}{r}
2{\cdot}36 \\
{\cdot}58 \\
\hline
1888 \\
1180 \\
\hline
1{\cdot}3688
\end{array}
$$

$$
\begin{array}{r}
14{\cdot}125)101{\cdot}9825(7{\cdot}22 \\
98875 \\
\hline
31075 \\
28250 \\
\hline
28250 \\
28250 \\
\hline
\end{array}
$$

(6)...

$$
\begin{array}{r}
£ \\
15750 \\
5\tfrac{1}{2} \\
\hline
78750 \\
7875 \\
\hline
86625 \text{ value of cargo} \\
15750 \text{ value of ship} \\
\hline
\end{array}
$$

$$24\left\{ \begin{array}{l} 3)\overline{102375} \\ 8)\ \overline{34125} \end{array} \right.$$

$$
\begin{array}{r}
4265 \quad 12 \quad 6 \\
7 \\
\hline
£29859 \quad 7 \quad 6
\end{array}
$$

(7)...

$$\tfrac{7}{8} \text{ mile} = 1540 \text{ yds.}$$
$$\tfrac{3}{4} \text{ mile} = 1320 \text{ yds.}$$

$$
\begin{array}{r}
30800 \\
4620 \\
1540 \\
\hline
\end{array}
$$

$$\text{1 acre} = 4840)2032800(420 \text{ acres}$$

$$
\begin{array}{r}
19360 \\
\hline
9680 \\
9680 \\
\hline
\dots\dots 0
\end{array}
$$

(8)... 1.

		s. d.			£	s.	d.	
		2 0	= 1/10 of £1		739	0	0	= value at £1 per bu.
		4	= 1/6 of 2s.		73	18	0	
		1	= 1/4 of 4d.		12	6	4	
		½	= ½ of 1d.		3	1	7	
					1	10	9½	
					£90	16	8½	

2.

$$10 \text{ cwt.} = \tfrac{1}{2} \text{ of } 1 \text{ ton}$$

	£	s.	d.	
	14	2		per ton
		7		
	4	19	2	
$2\tfrac{1}{2}$ cwt. $= \tfrac{1}{4}$ of 10 cwt.		7	1	
1 cwt. $= \tfrac{1}{10}$ of 10 cwt.		1	9¼	
			8½	
	£5	8	8¾	

3.

$$10 \text{ dwt.} = \tfrac{1}{2} \text{ of } 1 \text{ oz.}$$

	£	s.	d.	
	3	17	6	per ounce
		17		
	65	17	6	
5 dwt. $= \tfrac{1}{2}$ of 10 dwt.	1	18	9	
12 grs. $= \tfrac{1}{10}$ of 5 dwt.		19	4½	
		1	11¼	
	£68	17	6¾	

(9)...

$$1 - \tfrac{7}{9} = \tfrac{2}{9}$$

$$\tfrac{2}{9} \text{ of army} = \begin{cases} 750 \times 5 = 3750 \\ 850 \times 2 = 1700 \end{cases}$$

$$\overline{5450} \text{ men}$$

$$\tfrac{2}{9} \; : \; 1 \; :: \; 5450 \; : \; x$$

$$\frac{9}{2} \times \frac{\overset{2725}{\cancel{5450}}}{1} = 24525 \text{ men}$$

	la. da.	la. da.	£ s. d.	
(10)...	7×6 :	5×9 ::	3 13 6 :	x

$$\begin{array}{r} 20 \\ \hline 73 \\ 12 \\ \hline 882 \end{array}$$

$$x = \frac{5 \times 9 \times \cancel{882}}{7 \times \cancel{6}} = 945d. = £3 \ 18s. \ 9d.$$

EXERCISE LXXI.

		bu.
(1)...	From Portugal	218480
	„ Spain	158674
	„ The Azores ...	627709
	„ Sicily	140983
	„ other places...	8564

$$\begin{array}{r} 1154410 \text{ bushels} \\ 650 \\ \hline 57720500 \\ 6926460 \\ \hline 12)750366500 \text{ oranges} \\ \hline 62530541\tfrac{2}{3} \text{ dozen} \\ 4\tfrac{1}{2}d. \\ \hline 250122166\tfrac{2}{3} \\ 31265270\tfrac{5}{6} \\ \hline 12)281387437\tfrac{1}{2} \\ 20) \ 23448953 \ 1\tfrac{1}{2} \\ \hline £1172447 \ 13s. \ 1\tfrac{1}{2}d. \end{array}$$

(2)... $5\tfrac{1}{2} + 6\tfrac{1}{2} = 12$

			£ s.		£ s. d.
12	:	5½ ::	5707 10	:	2615 18 9

			£ s.		£ s. d.
12	:	6½ ::	5707 10	:	3091 11 3

(3)...

$$
\begin{array}{cc}
s. & d. \\
46 & 3 \\
43 & 6 \\
\end{array}
$$

profit in Essex wheat $\overline{\quad 2 \quad 9\quad}$ per quarter

$$
\begin{array}{cc}
s. & d. \\
58 & 6 \\
55 & 0 \\
\end{array}
$$

profit on Dantzic wheat $\overline{\quad 3 \quad 6\quad}$ per quarter

$$
\begin{array}{lrrr}
 & \pounds & s. & d. \\
2s.\ 9d. \times 65 = & 8 & 18 & 9 \\
3s.\ 6d. \times 85 = & 14 & 17 & 6 \\
\text{gain by whole} = & \pounds 23 & 16 & 3 \\
\end{array}
$$

(4)...

$$
\begin{array}{ccccccc}
\pounds & s. & & \pounds & & \pounds & s. & d. \\
36757 & 10 & : & 1 & :: & 12175 & 18 & 5\tfrac{1}{4} & : & x \\
2 & & & 2 & & & 20 & \\
\end{array}
$$

$$
\begin{array}{ccc}
73515 & 2 & 243518 \\
& & 12 \\
\end{array}
$$

$$
\begin{array}{c}
2922221 \\
4 \\
\hline
11688885 \\
\end{array}
$$

$$
x = \frac{2 \times \overset{159}{\cancel{11688885}}}{\cancel{73515}} = 318 \text{ far.} = 6s.\ 7\tfrac{1}{2}d. \text{ in the } \pounds
$$

(5)...

$$
3\tfrac{4}{5} + 4\tfrac{2}{9} + 5\tfrac{5}{8} + 6\tfrac{3}{10} = 18 + \tfrac{4}{5} + \tfrac{2}{9} + \tfrac{5}{8} + \tfrac{3}{10}
$$

$$
= 18 + \frac{288 + 80 + 225 + 108}{360}
$$

$$
= 18 + 1\tfrac{341}{360}
$$

$$
= 19\tfrac{341}{360}
$$

$$
25 - 19\tfrac{341}{360} = 5\tfrac{19}{360}
$$

(6)...

$$\frac{3}{4})\overline{5\frac{1}{4} \quad 7\frac{1}{2} \quad 9}$$
$$2)\overline{7 \quad 10 \quad 12}$$
$$\overline{7 \quad 5 \quad 6}$$

$$\text{L.C.M.} = \tfrac{3}{4} \times 2 \times 7 \times 5 \times 6 = 315$$

t.	qrs.	lb.

·034375 = 2 21

$$\underline{\quad 20 \quad}$$

·687500

$$\underline{\quad 4 \quad}$$

2·750000 qrs.

$$\underline{\quad 28 \quad}$$

21·000000 lb.

cwt.	qrs.	lb.

·90625 = 3 17½

$$\underline{\quad 4 \quad}$$

3·62500 qrs.

$$\underline{\quad 28 \quad}$$

17·50000 lb.

(7)...

3 qrs. 17½ lb. — 2 qrs. 21 lb. = 24½ lb.

(8)... 9 mi. 3 fur. 165½ yds. = 599958 in.

39·371)599958(15238·5766 mètres
39371
‾‾‾‾‾‾
206248
196855
‾‾‾‾‾
93930
78742
‾‾‾‾‾
151880
118113
‾‾‾‾‾
337670
314968
‾‾‾‾‾
227020
196855
‾‾‾‾‾
301650
275597
‾‾‾‾‾
260530
236226
‾‾‾‾‾
243040
236226
‾‾‾‾‾
12814

L

$$(9)... \quad 36 \text{ yds. at } 3d. = \begin{array}{cc} s. & d. \\ 9 & 0 \end{array}$$

$$\text{cost } 8 \quad 0$$

$$\text{profit } \overline{1 \quad 0} \text{ per piece}$$

$$\begin{array}{c} s. \\ 8 \end{array} \quad : \quad \begin{array}{c} s. \\ 1 \end{array} \quad :: \quad 100 \quad : \quad 12\tfrac{1}{2} \text{ per cent}$$

$$(10)... \quad \begin{array}{ccc} \text{fl.} & \text{w.} & \text{ho.} \\ 5 \times 32 \times 15 \end{array} \quad : \quad \begin{array}{ccc} \text{fl.} & \text{w.} & \text{ho.} \\ 5 \times 40 \times 17\tfrac{1}{2} \end{array} \quad :: \quad \begin{array}{c} \text{t.} \\ 10 \end{array} \quad : \quad x$$

$$\dfrac{2}{\overline{30}} \qquad\qquad \dfrac{2}{\overline{35}}$$

$$x = \dfrac{\overset{5}{\cancel{5} \times \cancel{40} \times 35 \times \cancel{10}}}{\underset{4 \quad 3}{\cancel{5} \times \cancel{32} \times \cancel{30}}} = \dfrac{175}{12} t. = 14 \tfrac{7}{12} \text{ tons}$$

EXERCISE LXXII.

$$(1)... \qquad 1 \text{ acre} = 4840 \text{ sq. yards}$$

$$\underline{5}$$

$$\overline{24200}$$

$$\underline{2}$$

$$137\tfrac{1}{2} \text{ yds.} \times 2 = 275\overline{)48400(}176 \text{ gardens}$$

$$\underline{275}$$

$$\overline{2090}$$

$$1925$$

$$\overline{1650}$$

$$1650$$

$$(2)... \qquad \begin{array}{cccc} \text{wks.} & \text{da.} & \text{hrs.} & \text{min.} \\ 35 & 3 & 15 & 25 \\ 17 & 6 & 22 & 39 \\ \hline 17 & 3 & 16 & 46 \\ 7 & & & \\ \hline 122 & & & \\ 24 & & & \\ \hline 504 & & & \\ 244 & & & \\ \hline 2944 & & & \\ 60 & & & \\ \hline 176686 & & & \\ 60 & & & \\ \hline 10601160 & \text{seconds} \end{array}$$

(3)...   5 cwt. 3 qrs. = 644 lb.

$$\begin{array}{r} 5d. \\ \hline 12)\overline{3220} \\ \hline 20)\overline{268 \quad 4} \\ \hline 13 \quad 8 \quad 4 \end{array}$$

11½ guineas = 12   1   6

profit £1   6   10

(4)...

$$\frac{11}{18}\text{ gui.} = \frac{11}{\underset{6}{\cancel{18}}} \times \frac{\overset{7}{\cancel{21}}}{1} = \frac{77}{6} = \overset{£}{0} \ \overset{s.}{12} \ \overset{d.}{10}$$

$$\frac{13}{15}\text{ sov.} = \frac{13}{\underset{3}{\cancel{15}}} \times \frac{\overset{4}{\cancel{20}}}{1} = \frac{52}{3} = 0 \ 17 \ 4$$

$$\frac{9}{16}\text{ cro.} = \frac{9}{16} \times \frac{5}{1} = \frac{45}{16} = 0 \ 2 \ 9\tfrac{3}{4}$$

$$\frac{7}{8}\text{ flo.} = \frac{7}{\underset{4}{\cancel{8}}} \times \frac{\cancel{2}}{1} = \frac{7}{4} = \begin{array}{rrr} 0 & 1 & 9 \\ \hline £1 & 14 & 8\tfrac{3}{4} \end{array}$$

(5)...

$$\frac{4}{9}\text{ of }\frac{3}{8}\text{ of }\frac{5}{6}\text{ of } 4\tfrac{1}{2}\text{ gui.} = \frac{\cancel{4}}{9} \times \frac{\cancel{3}}{\underset{2}{\cancel{8}}} \times \frac{5}{\underset{2}{\cancel{6}}} \times \frac{\overset{21}{\cancel{189}}}{2} = \frac{105}{8} = \overset{s.}{13} \ \overset{d.}{1\tfrac{1}{2}}$$

$$\frac{3}{7}\text{ of }\frac{5}{6}\text{ of }\frac{3}{10}\text{ of } 5\text{ gui.} = \frac{\cancel{3}}{7} \times \frac{\cancel{5}}{\underset{2}{\cancel{6}}} \times \frac{3}{\underset{2}{\cancel{10}}} \times \frac{\overset{15}{\cancel{105}}}{1} = \frac{45}{4} = \begin{array}{rr} 11 & 3 \\ \hline 1 & 10\tfrac{1}{2} \end{array}$$

(6)...   1. $(72 \cdot 65 + 109 \cdot 125 - 27 \cdot 19) \times 9 \cdot 14$

= 154·585 × 9·14

= 1412·9069

2. $\{(37{\cdot}42+21{\cdot}33)\times(50{\cdot}06-27{\cdot}56)\} \div 2{\cdot}35$

$= (58{\cdot}75 \times 22{\cdot}5) \div 2{\cdot}35$

$= 1321{\cdot}875 \div 2{\cdot}35$

$= 562{\cdot}5$

(7)...

gui.
$\cdot 5625 = 11s.\ 9\tfrac{3}{4}d.$
21
$\overline{11{\cdot}8125}s.$
12
$\overline{9{\cdot}7500}d.$
4
$\overline{3{\cdot}0000}$ far.

sov.
$\cdot 109375 = 2s.\ 2\tfrac{1}{4}d.$
20
$\overline{2{\cdot}187500}s.$
12
$\overline{2{\cdot}250000}d.$
4
$\overline{1{\cdot}000000}$ far.

hf. cr.
$\cdot 45 = 1s.\ 1\tfrac{1}{2}d.$
$2{\cdot}5s.$
$\overline{1{\cdot}125}s.$
12
$\overline{1{\cdot}500}d.$
4
$\overline{2{\cdot}000}$ far.

s.
$\cdot 8125 = 9\tfrac{3}{4}d.$
12
$\overline{9{\cdot}7500}d.$
4
$\overline{3{\cdot}0000}$ far.

s.	d.
11	$9\tfrac{3}{4}$
2	$2\tfrac{1}{4}$
1	$1\tfrac{1}{2}$
0	$9\tfrac{3}{4}$
$\overline{15s.}$	$\overline{11\tfrac{1}{4}}d.$

(8)...

$$12s.\ 6d. \times 2 = \overset{s.}{25}$$
$$5$$

wages of 2 men and 1 boy $= \overline{30}s.$ per week

10 gui. $\div$ 30s. $=$ 210s. $\div$ 30s. $= 7$

∴ he employs (2 men and 1 boy) $\times 7$

i.e. 14 men and 7 boys

	£	s.	d.
(9)...	533	12	6

5 per cent. $= \frac{1}{20} =$

26	13	$7\frac{1}{2}$	interest for 1 year
		$3\frac{1}{2}$	
80	0	$10\frac{1}{2}$	
13	6	$9\frac{3}{4}$	
£93	7	$8\frac{1}{4}$	interest for $3\frac{1}{2}$ years

(10)...

£		£	s.		£	s.		
$82\frac{1}{2}$	:	1113	15	::	3	10	:	income req.
20		20			20			
1650		22275			70			

$$\text{annual income} = \frac{\overset{27}{\cancel{22275}} \times \overset{35}{\cancel{70}}}{\underset{\cancel{2}}{\cancel{1650}}} = 945s. = £47 \ 5s.$$

EXERCISE LXXIII.

	£	s.	d.
(1)...	10297	18	10
		20	
	205958		
		12	
	4)2471506		
	617876	persons; and 2d. over	

(2)...

1. $$\frac{5}{13} - \frac{2}{9} + \frac{4}{11} + \frac{5}{6} - \frac{4}{7} = \frac{6930 - 4004 + 6552 + 15015 - 10296}{18018}$$

$$= \frac{14197}{18018}$$

2. $\dfrac{4\frac{1}{7}-2\frac{5}{6}}{8\frac{3}{7}+3\frac{5}{8}} = \dfrac{4\frac{6}{42}-2\frac{35}{42}}{8\frac{24}{56}+3\frac{35}{56}} = \dfrac{1\frac{13}{42}}{12\frac{3}{56}} = \dfrac{\frac{55}{42}}{\frac{675}{56}}$

$$= \dfrac{\overset{11}{\cancel{55}}\times\overset{4}{\cancel{56}}}{\underset{135}{\cancel{675}}\times\underset{3}{\cancel{42}}} = \dfrac{44}{405}$$

$$\dfrac{5\frac{4}{9}+6\frac{2}{5}}{7\frac{1}{5}-1\frac{5}{9}} = \dfrac{5\frac{20}{45}+6\frac{18}{45}}{7\frac{9}{45}-1\frac{25}{45}} = \dfrac{11\frac{38}{45}}{5\frac{29}{45}} = \dfrac{\frac{533}{45}}{\frac{264}{45}} = \dfrac{533}{254}$$

$$\dfrac{\overset{22}{\cancel{44}}}{405}\times\dfrac{533}{\underset{127}{\cancel{254}}} = \dfrac{11726}{51435}$$

3. $\dfrac{8\frac{1}{3}}{10\frac{5}{6}} = \dfrac{\frac{25}{3}}{\frac{65}{6}} = \dfrac{\overset{5}{\cancel{25}}\times\overset{2}{\cancel{6}}}{\underset{13}{\cancel{65}}\times\cancel{3}} = \dfrac{10}{13}$

$$\dfrac{5\frac{4}{7}}{7} = \dfrac{\frac{39}{7}}{\frac{7}{1}} = \dfrac{39}{49} \qquad\qquad \dfrac{8}{9\frac{3}{5}} = \dfrac{\frac{8}{1}}{\frac{48}{5}} = \dfrac{40}{48} = \dfrac{5}{6}$$

$$\dfrac{6\frac{3}{10}}{4\frac{1}{2}} = \dfrac{\frac{63}{10}}{\frac{9}{2}} = \dfrac{\overset{7}{\cancel{63}}\times\cancel{2}}{\cancel{9}\times\underset{5}{\cancel{10}}} = \dfrac{7}{5}$$

$$\dfrac{\overset{5}{\cancel{10}}}{\cancel{13}}\times\dfrac{\overset{3}{\cancel{39}}}{\underset{7}{\cancel{49}}}\times\dfrac{\cancel{5}}{\underset{2}{\cancel{6}}}\times\dfrac{7}{\cancel{5}} = \dfrac{5}{7}$$

(3)...
$$\frac{7}{270} \text{yd.} = \frac{7}{270} \times \frac{36}{1} = \frac{14}{15} \text{ of an inch;}$$

$$\frac{9}{10} \text{in.} = \frac{9}{10} \times \frac{1}{36} = \frac{1}{40} \text{ of a yard}$$

(4)...

79·2416	·056)·019320(·345
·076	168
4754496	252
5546912	224
6·0223616	280
	280

(5)...

gui.
·9375 = 19*s.* 8¼*d.*
21
19·6875*s.*
12
8·2500*d.*
4
1·0000 far.

4) 1
12)11·25
40)13·9375
·3484375 of a sov.

13*s.* 11¼*d.* =

(6)...

			s.	*d.*		£	*s.*	*d.*
2⅝ yds.	Black cloth......		16	6	=	2	3	3¾
2⅜ ,,	Doeskin		7	6	=	0	17	9¾
3¼ ,,	Alpaca...........		1	6	=	0	4	10½
1¾ ,,	Shalloon		1	8	=	0	2	11
5⅛ ,,	Scarlet flannel .		1	10	=	0	10	1
						£3	19	0

(7)...

		s.	*d.*		£	*s.*	*d.*
19¾ yds. at		11	6 per yard	=	11	7	1½
23¾ ,,		12	6 ,,	=	14	16	10½
43½			selling price		26	4	0
			cost price		22	5	10½
			profit		£3	18	1½

(8)...   Longitude of Vienna ....16° 23′ E.

„   Washington ...77° 1′ W.

difference of longitude = 93° 24′

$$1° : 93° 24′ :: \overset{\text{min.}}{4} : x$$

$$60 \qquad 60$$

$$\overline{60} \qquad \overline{5604}$$

$$x = \frac{\overset{1868}{\cancel{5604}} \times \cancel{4}}{\underset{\underset{5}{\cancel{15}}}{\cancel{60}}} = \frac{1868}{5} \text{ min.} = 6 \text{ hrs. } 13 \text{ min. } 36 \text{ sec.}$$

∴ the clocks of Vienna are 6 hrs. 13 min. 36 sec. in advance of those of Washington.

(9)...

per cent.	£	s.	d.
$2\frac{1}{2} = \frac{1}{40}$ of 100	593	10	0
$1\frac{1}{4} = \frac{1}{2}$ of $2\frac{1}{2}$	14	16	9
	7	8	$4\frac{1}{2}$
	22	5	$1\frac{1}{4}$ int. for 1 year
			$5\frac{1}{2}$
	111	5	$7\frac{1}{2}$
	11	2	$6\frac{3}{4}$
	£122	8	$2\frac{1}{4}$ int. for $5\frac{1}{2}$ years

	£	s.	d.
Principal...	593	10	0
Interest ...	122	8	$2\frac{1}{4}$
Amount ...	715	18	$2\frac{1}{4}$

(10)...

$$\overset{£}{73\frac{7}{8}} : \overset{£}{1250} :: \overset{£}{100} : \text{stock required}$$

$$8 \qquad\qquad 8$$

$$\overline{591} \qquad \overline{10000}$$

∴ stock required $= \dfrac{10000 \times 100}{591} = £\dfrac{1000000}{591}$

$= £1692 \ 0s. \ 11\frac{73}{197}d.$

EXERCISE LXXIV.

(1)... 1.

	s.	d.		£	s.	d.	
	2	6	$= \frac{1}{8}$ of £1	349	0	0	= value at £1 per cwt.
	1	0	$= \frac{1}{20}$ of £1	43	12	6	
	1½	$= \frac{1}{8}$ of 1s.		17	9	0	
				2	3	7½	
				£412	5	1½	

2.

s.	d.
13	9 per E. ell

$6 \times 12 + 1 = 73$

4	2	6
		12

qrs.	na.		49	10	0
2	2	$= \frac{1}{2}$ of 1 ell	13	9	
1	0	$= \frac{1}{5}$ of 1 ell	6	10½	
			2	9	
			£50	13	4½

3.

£	s.	d.
12	12	0 per acre

$3 \times 11 + 1 = 34$

37	16	0
		11

ro.	po.		415	16	0
2	0	$= \frac{1}{2}$ of 1 ac.	12	12	0
1	0	$= \frac{1}{2}$ of 2 ro.	6	6	0
	20	$= \frac{1}{2}$ of 1 ro.	3	3	0
	5	$= \frac{1}{4}$ of 20 po.	1	11	6
			7	10½	
			£439	16	4½

(2)...Right length = 42 yds. $-$ ($\frac{3}{4}$ in. $\times$ 42) = 42 yds. $-$ 31½ in.

= 41 yds. 4½ in.

= 41⅛ yds.

(3)...

$$3\tfrac{4}{5} + 2\tfrac{3}{8} = 3\tfrac{32}{40} + 2\tfrac{15}{40} = 6\tfrac{7}{40} \text{ sum}$$

$$3\tfrac{4}{5} - 2\tfrac{3}{8} = 3\tfrac{32}{40} - 2\tfrac{15}{40} = 1\tfrac{17}{40} \text{ difference}$$

$$3\tfrac{4}{5} \times 2\tfrac{3}{8} = \tfrac{19}{5} \times \tfrac{19}{8} = \tfrac{361}{40} = 9\tfrac{1}{40} \text{ product}$$

$$3\tfrac{4}{5} \div 2\tfrac{3}{8} = \frac{\cancel{19}}{5} \times \frac{8}{\cancel{19}} = \frac{8}{5} = 1\tfrac{3}{5} \text{ quotient}$$

(4)...
$$25\begin{cases}5)\overline{7} \\ 5)\overline{1\cdot4}\end{cases}$$
$$\qquad \overline{\cdot28}$$

$$32\begin{cases}4)\overline{13} \\ 8)\overline{3\cdot35}\end{cases}$$
$$\qquad\qquad \overline{\cdot40625}$$

(5)...

$$\frac{7}{24}\text{ gui.} = \frac{7}{\cancel{24}_8}\times\frac{\overset{7}{\cancel{21}}}{1} = \frac{49}{8} = 6s.\ 1\tfrac{1}{2}d.$$

$$\overset{\text{sov.}}{\cdot528125} = 10s\ 6\tfrac{3}{4}d.$$
$$\underline{20}$$
$$\overline{10\cdot562500}s.$$
$$\underline{12}$$
$$\overline{6\cdot750000}d.$$
$$\underline{4}$$
$$\overline{3\cdot000000}\text{ far.}$$

$$10s.\ 6\tfrac{3}{4}d. - 6s.\ 1\tfrac{1}{2}d. = 4s.\ 5\tfrac{1}{4}d.$$

(6)...

$$5\text{ fur. }137\tfrac{1}{2}\text{ yds.} = 2475\text{ hf.-yds.}$$
$$1\text{ mile} = 3520\qquad,,$$

$$\tfrac{2475}{3520}\div\tfrac{55}{55} = \tfrac{45}{64}\text{ of a mile}$$

$$4)\ \underline{\ 2\ }$$
$$40)\overline{22\cdot5}$$
$$4)\ \overline{\ 2\cdot5625}$$
$$2\text{ ro. }22\tfrac{1}{2}\text{ per.} = \overline{\quad\cdot640625}\text{ of an acre}$$

(7)...

$$11 + 3 = 14$$

$$14\quad:\quad11\quad::\quad\overset{\pounds\quad s.}{58\ \ 16}\quad:\quad\text{cost of horse}$$
$$\underline{20}$$
$$\overline{1176}$$

$$\overset{84}{}$$

$$\text{cost of horse} = \frac{11\times\cancel{1176}}{\cancel{14}} = 924s. = \pounds46\ 4s.$$

$$\therefore\ \text{the cost of the harness} = \pounds58\ 16s. - \pounds46\ 4s.$$
$$= \pounds12\ 12s.$$

(8)...

$$\begin{aligned} &\text{If A has} \quad 4 \text{ shares} \\ &\text{B will have} \quad 6 \quad \text{,,} \\ &\text{and C} \quad \text{,,} \quad 15 \quad \text{,,} \end{aligned}$$

∴ the property must be divided into 25 shares

$$25 \begin{cases} 5)\overline{578 \quad 2 \quad 6} \\ 5)\overline{115 \quad 12 \quad 6} \end{cases}$$
$$\overline{£23 \quad 2 \quad 6} \text{ value of each share}$$

£23 2s. 6d. × 4 = £92 10s. 0d.......A's portion

£23 2s. 6d. × 6 = £138 15s. 0d.......B's ,,

£23 2s. 6d. ×15 = £346 17s. 6d.......C's ,,

(9) ..

men da.		men da.		lb.		lb.
23 × 17	:	35 × x	::	488¾	:	1881¼
				4		4
				1955		7525

$$x = \frac{23 \times 17 \times 7525}{35 \times 1955} = 43 \text{ days}$$

(10)...

per. da.		per. da.		£ s.		
3 × 11	:	7 × 35	::	24 15	.	x
				20		
				495		

$$x = \frac{7 \times 35 \times 495}{3 \times 11} = 3675s. = £183 \ 15s.$$

EXERCISE LXXV.

			s.	*d.*	*£*	*s.*	*d.*
(1)...	11½ yds.	Glacé Silk.........5	5	6	= 3	3	3
	1¼ „	Silk Velvet 8	8	6	= 0	10	7½
	6¾ „	French Merino ...4	4	9	= 1	12	0¾
	7½ „	Lining 0	0	6½	= 0	4	0¾
	10½ „	Calico 0	0	8½	= 0	7	5¼
	6¾ „	Flannel 1	1	10	= 0	12	4½
	4½ „	Ribbon 0	0	10½	= 0	3	11¼
	8 Cambric Handkerchiefs	2	2	9	= 1	2	0
	3 pairs Kid Gloves 2		2	6	= 0	7	6
					£8	3	3

(2)...
$$\cdot 4375 = \tfrac{4375}{10000} = \tfrac{7}{16}$$

$$
16 \left\{
\begin{array}{l}
\underline{£\quad s.\quad d.} \\
4)747\ \ 15\ \ 0 \\
4)\overline{186\ \ 18\ \ 9} \\
\overline{46\ \ 14\ \ 8\tfrac{1}{4}} \\
7 \\
\overline{£327\ \ \ 2\ \ 9\tfrac{3}{4}}
\end{array}
\right.
$$

(3)...
$$22s.\ 6d. \times 75 = 1687 \quad 6 \text{ value of oats}$$

$$43s.\ 9d. = 525)\overline{20250}(38\tfrac{4}{7} \text{ quarters of wheat}$$
$$
\begin{array}{r}
1575 \\
\hline
4500 \\
4200 \\
\hline
300 \\
\hline
\end{array}
\ \tfrac{300}{525} = \tfrac{4}{7}
$$

(4)...

			£	*s.*
47	sheep cost		67	10
35	„	„	55	0
82	„	„	122	10

	£	*s.*
82 sheep at 30s. each =	123	0
cost	122	10
profit		10s.

	s.	d.		£	s.	d.	
(5)...	10	0	$= \frac{1}{2}$ of £1	1747	0	0	value at £1 each
	4	0	$= \frac{1}{5}$ of £1	873	10	0	
		10	$= \frac{1}{12}$ of 10s.	349	8	0	
		$\frac{1}{2}$	$= \frac{1}{20}$ of 10d.	72	15	10	
		$\frac{1}{4}$	$= \frac{1}{2}$ of $\frac{1}{2}$d.	3	12	$9\frac{1}{2}$	
				1	16	$4\frac{3}{4}$	
				£1301	3	$0\frac{1}{4}$	

	s.	d.		£	s.	d.	
	10	0	$= \frac{1}{2}$ of £1	2139	0	0	value at £1 each
	6	8	$= \frac{1}{3}$ of £1	1069	·10	0	
	1	8	$= \frac{1}{4}$ of 6s. 8d.	713	0	0	
	1		$= \frac{1}{20}$ of 1s. 8d.	178	5	0	
		$\frac{1}{2}$	$= \frac{1}{2}$ of 1d.	8	18	3	
				4	9	$1\frac{1}{2}$	
				£1974	2	$4\frac{1}{2}$	

(6)...   1. $\dfrac{7\frac{5}{6}+\frac{4}{9}-2\frac{5}{12}}{4\frac{2}{3}-3\frac{1}{6}+8\frac{5}{8}} = \dfrac{7\frac{30}{36}+\frac{16}{36}-2\frac{15}{36}}{4\frac{16}{24}-3\frac{4}{24}+8\frac{15}{24}} = \dfrac{5\frac{31}{36}}{10\frac{3}{24}}$

$$= \dfrac{\frac{211}{36}}{\frac{243}{24}} = \dfrac{211 \times \overset{2}{\cancel{24}}}{243 \times \underset{3}{\cancel{36}}} = \dfrac{422}{729}$$

2. $\dfrac{\frac{7}{9} \text{ of } \frac{11}{14} \text{ of } 5\frac{8}{11}}{\frac{9}{10} \text{ of } \frac{13}{18} \text{ of } 5\frac{5}{13}} = \dfrac{\dfrac{7}{9}\times\dfrac{\overset{}{\cancel{11}}}{\underset{2}{\cancel{14}}}\times\dfrac{\overset{7}{\cancel{63}}}{\cancel{11}}}{\dfrac{\cancel{9}}{\cancel{10}}\times\dfrac{\cancel{13}}{\cancel{18}}\times\dfrac{\overset{7}{\cancel{70}}}{\underset{2}{\cancel{13}}}} = \dfrac{\frac{7}{2}}{\frac{7}{2}} = 1$

	£	s.	d.			£	s.	d.
(7)... 18{	3)5	15	6		14{	7)5	2	1
	6)1	18	6			2)	14	7
		6	5				7	$3\frac{1}{2}$
			7					9
	£2	4	11			£3	5	$7\frac{1}{2}$

£3 5s. $7\frac{1}{2}$d. $-$ £2 4s. 11d. $=$ £1 0s. $8\frac{1}{2}$d.

(8)...   ·1125 of 7 sov. = 15s. 9d.

$$\frac{7}{\cdot7875}\text{ of 1 sov.}$$

$$\frac{20}{15\cdot7500s.}$$

$$\frac{12}{9\cdot0000d.}$$

$$12)\overline{\quad9\quad}$$

$$21)\overline{15\cdot75}$$

15s. 9d. =   ·75 of a guinea

(9)...

	£	s.	d.
112 lb. at 5½d. per lb. =	2	11	4
cost per cwt. =	2	6	8
profit per cwt. =		4	8

£	s.	d.		s.	d.				
2	6	8	:	4	8	::	100	:	10 per cent.

(10)...

$$3\tfrac{1}{2} \quad : \quad 83\tfrac{1}{2} \quad :: \quad \overset{£}{175} \quad : \quad x$$

$$\frac{2}{7} \qquad \frac{2}{167}$$

$$x = \frac{167 \times \overset{25}{175}}{7} = £4175$$

EXERCISE LXXVI.

(1)...

$$3\tfrac{1}{2} + 4\tfrac{3}{4} + 6\tfrac{3}{4} = 15$$

$$2s.\ 6d. \div 15 = 2d.$$

	s.	d.
2d. × 3½ =		7
2d. × 4¾ =		9½
2d. × 6¾ =	1	1½
	2s.	6d.

(2)...
$$5\tfrac{1}{4}+7\tfrac{1}{2}+8\tfrac{1}{4}+9 = 30$$
$$10s. \div 30 = 4d.$$

$$
\begin{array}{rcl}
 & & \;\;s.\;\;\;d. \\
4d. \times 5\tfrac{1}{4} &=& 1\;\;\;9 \\
4d. \times 7\tfrac{1}{2} &=& 2\;\;\;6 \\
4d. \times 8\tfrac{1}{4} &=& 2\;\;\;9 \\
4d. \times 9\phantom{\tfrac{1}{4}} &=& 3\;\;\;0 \\
\hline
 & & 10s.\;\;0d.
\end{array}
$$

(3)...
$$
\begin{array}{r|rrr}
 & \pounds & s. & d. \\
5) & 38 & 3 & 9 \\
\hline
 & 7 & 12 & 9 \\
 & & & 13 \\
\hline
\pounds99 & & 5 & 9
\end{array}
$$

(4)...1.

qrs.	lb.				£	s.	d.	
2	0	= ½ of 1 cwt.			3	10	0	per cwt.
							19	
					66	10	0	
1	0	= ½ of 2 qrs.			1	15	0	
	14	= ½ of 1 qr.				17	6	
	7	= ½ of 14 lb.				8	9	
	3½	= ½ of 7 lb.				4	4½	
						2	2¼	
					£69	17	9¾	

2.

			£	s.	d.	
4 bu.	= ½ of 1 qr.		3	12	0	per quarter
					9	
			32	8	0	
1 bu.	= ¼ of 4 bu.		1	16	0	
2 pks.	= ½ of 1 bu.			9	0	
1 pk.	= ½ of 2 pks.			4	6	
				2	3	
			£34	19	9	

3.   2 ro. $= \frac{1}{2}$ of 1 acre

$$
\begin{array}{rrl}
£ & s. & d. \\
2 & 2 & 0 \text{ per acre} \\
 & & 9 \times 9 = 81 \\
\hline
18 & 18 & 0 \\
 & & 9 \\
\hline
170 & 2 & 0 \\
\end{array}
$$

1 ro. $= \frac{1}{2}$ of 2 roods   1   1   0

20 per. $= \frac{1}{2}$ of 1 rood   10   6

5 per. $= \frac{1}{4}$ of 20 per.   5   3

     1   $3\frac{3}{4}$

$£172$ 0 $0\frac{3}{4}$

4.
qrs. na.

2   2 $= \frac{1}{2}$ of 1 ell |
s.   d.

1   0 $= \frac{1}{8}$ of 1 ell   12   6 per ell

     11

6   17   6

    6   3

    2   6

$£7$ 6   3

(5)...

$$7\tfrac{11}{12} + 5\tfrac{4}{9} = 7\tfrac{33}{36} + 5\tfrac{16}{36} = 13\tfrac{13}{36}$$

$$7\tfrac{11}{12} - 5\tfrac{4}{9} = 7\tfrac{33}{36} - 5\tfrac{16}{36} = 2\tfrac{17}{36}$$

$$13\tfrac{13}{36} \times 2\tfrac{17}{36} = \tfrac{481}{36} \times \tfrac{89}{36} = \tfrac{42809}{1296} = 33\tfrac{41}{1296}$$

(6)...

cwt.

$\cdot 09375 = 10$ lb. 8 oz.

    4

$\overline{\cdot 37500}$

   28

$\overline{10 \cdot 50000}$ lb.

   16

$\overline{8 \cdot 00000}$ oz.

4) 1

12)$\overline{11 \cdot 25}$

21) $\overline{3 \cdot 9375}$

$3s.\ 11\frac{1}{4}d. = \cdot 1875$ of a guinea

(7)...   sov.   gui.

$$\begin{array}{ll}
\cdot265625 = 5s.\ 3\tfrac{3}{4}d. & \quad \cdot4375 = 9s.\ 2\tfrac{1}{4}d. \\
\quad\quad 20 & \quad\quad\quad 21 \\
\overline{5\cdot312500s.} & \quad \overline{9\cdot1875s.} \\
\quad\quad 12 & \quad\quad\quad 12 \\
\overline{3\cdot750000d.} & \quad \overline{2\cdot2500d.} \\
\quad\quad 4 & \quad\quad\quad 4 \\
\overline{3\cdot000000 \text{ far.}} & \quad \overline{1\cdot0000 \text{ far.}}
\end{array}$$

$$\begin{array}{rr}
s. & d. \\
9 & 2\tfrac{1}{4} \\
5 & 3\tfrac{3}{4} \\
\hline
3 & 10\tfrac{1}{2}
\end{array}$$

(8)...$2\tfrac{1}{2}$ per cent.$=\frac{1}{40}$ of 100
$\quad\ 1\tfrac{1}{4}$ „ „ $=\frac{1}{2}$ of $2\tfrac{1}{2}$

$$\begin{array}{rrr}
£ & s. & d. \\
397 & 16 & 8 \\
\hline
9 & 18 & 11 \\
4 & 19 & 5\tfrac{1}{2} \\
\hline
14 & 18 & 4\tfrac{1}{2} \text{ interest for 1 year} \\
 & & 3 \\
\hline
44 & 15 & 1\tfrac{1}{2} \\
7 & 9 & 2\tfrac{1}{4} \\
4 & 19 & 5\tfrac{1}{2} \\
\hline
£57 & 3 & 9\tfrac{1}{4} \text{ int. for 3 yrs. 10 mo.}
\end{array}$$

6 mo. $= \tfrac{1}{2}$ of 1 yr. $=$ 7 9 2$\tfrac{1}{4}$
4 mo. $= \tfrac{1}{3}$ „ „ $=$ 4 19 5$\tfrac{1}{2}$

(9)...

$$\begin{array}{cccccc}
£ & & £ & & £ & s.\ \ d. \\
82 & : & 4 & :: & 1422 & 3\ \ \ 9 \quad : \quad \text{income required} \\
 & & & & 20 & \\
\end{array}$$

$$\overline{28443}$$
$$\quad 12$$
$$\overline{341325}$$

$$\quad 2\quad 8325$$

annual income $= \dfrac{\cancel{4}\times\cancel{341325}}{\cancel{82}} = 16650d. = £69\ 7s.\ 6d.$

$$\cancel{41}$$

$$\text{)...}\quad \begin{array}{c} \text{cwt. qrs. lb.} \quad \text{mi.} \\ 2 \quad 3 \quad 14 \times 126 \\ 4 \\ \hline 11 \\ 28 \\ \hline 322 \end{array} : \begin{array}{c} \text{cwt. qr. lb.} \quad \text{mi.} \\ 7 \quad 1 \quad 16 \times 140 \\ 4 \\ \hline 29 \\ 28 \\ \hline 828 \end{array} :: \begin{array}{c} s. \quad d. \\ 13 \quad 5 \\ 12 \\ \hline 161 \end{array} : x$$

$$x = \frac{\overset{46}{\cancel{828}} \times \overset{20}{\cancel{140}} \times \overset{10}{\cancel{161}}}{\underset{2}{\cancel{322}} \times \underset{7}{\cancel{126}}} = 460d. = \pounds 1 \ 18s. \ 4d.$$

EXERCISE LXXVII.

(1)...

$$\begin{array}{llll}
 & & & s. \quad d. \\
1 & \text{lb. of Tea} & \ldots\ldots\ldots\ldots & = 4 \quad 8 \\
3\frac{1}{2} & \text{,, \quad Coffee} & \ldots\ldots\ldots\ldots & = 4 \quad 8 \\
1\frac{3}{4} & \text{,, \quad do.} & \ldots\ldots\ldots\ldots & = 2 \quad 4 \\
4 & \text{,, \quad Lump sugar} & \ldots & = 2 \quad 4 \\
2\frac{1}{2} & \text{,, \quad do. \quad do.} & \ldots & = 1 \quad 5\frac{1}{2} \\
3\frac{1}{2} & \text{,, \quad Moist \quad do.} & \ldots & = 1 \quad 5\frac{1}{2} \\
7 & \text{,, \quad do. \quad do.} & \ldots & = 2 \quad 11 \\
10 & \text{,, \quad Rice} & \ldots\ldots\ldots\ldots & = 2 \quad 11 \\
1 & \text{,, \quad do.} & \ldots\ldots\ldots\ldots & = \quad 3\frac{1}{2} \\
\end{array}$$

(2)...

2 roods = $\frac{1}{2}$ of 1 acre

20 per. = $\frac{1}{4}$ of 2 ro.

$$\begin{array}{rrr}
\pounds & s. & d. \\
2 & 2 & 0 \quad \text{per acre} \\
& & 125 \\
\hline
262 & 10 & 0 \\
1 & 1 & 0 \\
0 & 5 & 3 \\
\hline
\pounds 263 & 16 & 3 \\
\end{array}$$

(3)...

$$53\frac{1}{7} \div 3\frac{7}{8} = \frac{\overset{12}{\cancel{372}}}{7} \times \frac{8}{\cancel{31}} = \frac{96}{7} = 13\frac{5}{7}$$

(4)...
$$11s.\ 10\tfrac{1}{2}d. = 285 \text{ halfpence}$$
$$\pounds 1 = 480 \quad \text{,,}$$
$$\tfrac{285}{480} \div \tfrac{15}{15} = \tfrac{19}{32} \text{ of } \pounds 1$$

$$4\,)\,1$$
$$12\,)\,\overline{2{\cdot}25}$$
$$21\,)\,\overline{9{\cdot}1875}$$
$$9s.\ 2\tfrac{1}{4}d. = \overline{\quad {\cdot}4375} \text{ of a guinea}$$

(5)... **From Monday, 4 P.M., to Friday, noon = 92 hours**

hrs.		hrs.		min.	sec.		
24	:	92	::	4	45	:	x

$$60$$
$$\overline{285}$$

$$x = \frac{\overset{23}{\cancel{92}} \times \overset{95}{\cancel{285}}}{\underset{\underset{2}{\cancel{6}}}{\cancel{24}}} = \frac{2185}{2} = 1092\tfrac{1}{2} \text{ sec.} = 18 \text{ min. } 12\tfrac{1}{2} \text{ sec.}$$

∴ the clock will show 18 min. 12½ sec. past 12

(6)...

hor.	da.		hor.	da.		qrs.		
800	× 20	:	860	× 112	::	375	:	x

$$x = \frac{\overset{43}{\cancel{860}} \times \overset{7}{\cancel{112}} \times \overset{15}{\cancel{375}}}{\underset{\underset{2}{\cancel{32}}}{\cancel{800}} \times \cancel{20}} = \frac{4515}{2} \text{ qrs.} = 2257\tfrac{1}{2} \text{ qrs.}$$

(7)...

$\pounds$	$s.$	$d.$	
602	17	6	amount
520	0	0	principal
$\pounds$82	17	6	interest for $3\tfrac{3}{4}$ years

$\pounds 82\ 17s.\ 6d. \div 3\tfrac{3}{4} = \pounds 22\ 2s.$ interest for 1 year

$\pounds$		$\pounds$		$\pounds$	$s.$		
520	:	100	::	22	2	:	x

$$20$$
$$\overline{442}$$

$$x = \frac{\overset{5}{\cancel{100}} \times \overset{17}{\cancel{442}}}{\underset{\underset{20}{\cancel{520}}}{\cancel{520}}} = 85s. = \pounds 4\tfrac{1}{4} \text{ per cent.}$$

(8)...   Loss on sale of £100 stock $= 83\frac{5}{8} - 79\frac{3}{4} = £3\frac{7}{8}$

Total loss $= £3\frac{7}{8} \times 25 = £96\frac{7}{8} = £96\ 17s.\ 6d.$

(9)...

$$\begin{array}{r} 100 \\ 10 \\ \hline 110 \end{array}$$

$$110 : 100 :: \begin{array}{cc} £ & s. \\ 74 & 5 \end{array}$$

$$\begin{array}{ccc} 11 & 10 & 10 \end{array}$$

$$11)\overline{742\ \ 10}$$

cost of 36 sheep   £67 10

cost of each sheep $= £67\ 10s. \div 36 = £1\ 17s.\ 6d.$

(10)...

$$\begin{array}{ccccc} £ & & £ & & £ \quad s. \quad d. \\ 2625 & : & 3250 & :: & 377 \quad 6 \quad 10\frac{1}{2} \quad : \quad \text{B's share} \end{array}$$

$$\begin{array}{r} 20 \\ \hline 7546 \\ 12 \\ \hline 90562 \\ 4 \\ \hline 362250 \end{array}$$

B's share $= \dfrac{\cancel{3250} \times \cancel{362250}}{\cancel{2625}} = 448500$ far. $= £467\ 3s.\ 9c$

$$\begin{array}{ccccc} £ & & £ & & \text{far.} \\ 2625 & : & 4825 & :: & 362250 \quad : \quad \text{C's share} \end{array}$$

C's share $= \dfrac{\cancel{4825} \times \cancel{362250}}{\cancel{2625}} = 665850$ far. $= £693\ 11s.\ 1$

EXERCISE LXXVIII.

(1)...

			s.	d.	£	s.	d.
19½ yds.	Calico		0	7½	= 0	12	2¼
16¾ „	Flannel		1	2	= 0	19	6½
11½ „	Bro. Holland		0	10	= 0	9	7
15¼ „	Print		0	8½	= 0	10	11¾
3¾ „	Book Muslin		1	6	= 0	5	7½
17½ „	Irish Linen		1	3	= 1	1	10½
13¼ „	Sheeting		1	5	= 0	18	9¼
9 „	Ribbon		0	7¾	= 0	5	9¾
10½ „	do.		0	4½	= 0	3	11¼
					£5	8	3¾

(2)...

$$18\tfrac{3}{4}\times4=75$$

	£	s.	d.
	295	1	6¾
			4
5)1180		6	3
5)236		1	3
3)47		4	3
£15		14	9

(3)...

qrs.	bu.	pks.	gal.
19	3	2	1
		8×7+1	= 57
155	5	0	0
			7
1089	3	0	0
19	3	2	1
1108	6	2	1

4)...

$$\left(1\tfrac{2}{9}\right)^2\times\left(2\tfrac{1}{4}\right)^3 = \frac{11}{9}\times\frac{11}{9}\times\frac{9}{4}\times\frac{9}{4}\times\frac{9}{4} = \frac{1089}{64} = 17\tfrac{1}{64}$$

(5)... $$\left(\tfrac{11}{15} \text{ of } \tfrac{9}{10} \text{ of } 6\tfrac{5}{6}\right) \div \left(\tfrac{7}{8} \text{ of } \tfrac{11}{12} \text{ of } 3\tfrac{1}{8}\right)$$

$$= \frac{\overset{}{\cancel{11}}}{\underset{5}{\cancel{15}}} \times \frac{\overset{3}{\cancel{9}}}{\underset{2}{\cancel{10}}} \times \frac{41}{\underset{2}{\cancel{6}}} \times \frac{\cancel{8}}{7} \times \frac{\overset{4}{\cancel{12}}}{\cancel{11}} \times \frac{\cancel{5}}{\underset{2}{\cancel{16}}}$$

$$= \tfrac{123}{70} = 1\tfrac{53}{70};$$

$$\frac{7}{12} \text{ of } \frac{9}{14} \text{ of } 17 = \frac{7}{\underset{4}{\cancel{12}}} \times \frac{\overset{3}{\cancel{9}}}{\underset{2}{\cancel{14}}} \times \frac{17}{1} = \frac{51}{8} = 6\tfrac{3}{8}$$

$$\frac{8}{9} \text{ of } \frac{15}{16} \text{ of } 25\tfrac{1}{2} = \frac{\cancel{8}}{\underset{3}{\cancel{9}}} \times \frac{\overset{5}{\cancel{15}}}{\underset{2}{\cancel{16}}} \times \frac{\overset{17}{\cancel{51}}}{2} = \frac{85}{4} = 21\tfrac{1}{4}$$

$$21\tfrac{1}{4} - 6\tfrac{3}{8} = 21\tfrac{2}{8} - 6\tfrac{3}{8} = 14\tfrac{7}{8}$$

(6)... $$\frac{13}{24} \text{ hf. gui.} = \frac{13}{\underset{8}{\cancel{24}}} \times \frac{\overset{7}{\cancel{21}}}{2} = \frac{91}{16} = \begin{array}{cc} s. & d. \\ 5 & 8\tfrac{1}{4} \end{array}$$

$$\frac{11}{32} \text{ sov.} = \frac{11}{\underset{8}{\cancel{32}}} \times \frac{\overset{5}{\cancel{20}}}{1} = \frac{55}{8} = \frac{\begin{array}{cc} 6 & 10\tfrac{1}{2} \end{array}}{\begin{array}{cc} 12 & 6\tfrac{3}{4} \end{array}}$$

$$\begin{array}{l}
4)\ \underline{3} \\
12)\ \underline{6\cdot75} \\
20)\underline{12\cdot5625} \\
5)\ \underline{\cdot628125}
\end{array}$$

12s. 6¾d. = ·125625 of £5

(7)... $$\overset{\text{yds.}}{7\tfrac{7}{10}} \ : \ \overset{\text{yds.}}{19\tfrac{9}{16}} \ :: \ \overset{\pounds}{1\tfrac{37}{40}} \ : \ x$$

$$x = \frac{\cancel{10}}{77} \times \frac{313}{16} \times \frac{77}{\underset{4}{\cancel{40}}} = \pounds\frac{313}{64} = \pounds4\ 17s.\ 9\tfrac{3}{4}d.$$

(8)... £527 10s. + £753 15s. + £815 15s. = £2097

$$
\begin{array}{ccccccc}
£ & & £ & s. & & £ & s. \\
2097 & : & 527 & 10 & :: & 873 & 15 & : \quad \text{A's portion} \\
\underline{\;2\;} & & \underline{\;2\;} & & & \underline{20} & \\
4194 & & 1055 & & & 17475 &
\end{array}
$$

$$
\text{A's portion} = \frac{1055 \times \overset{25}{\cancel{17475}}}{\underset{6}{\cancel{4194}}} = \frac{26375}{6}s. = £219\ 15s.\ 10d.
$$

$$
\begin{array}{ccccccc}
£ & & £ & s. & & s. & \\
2097 & : & 753 & 15 & :: & 17475 & : \quad \text{B's portion} \\
\underline{\;4\;} & & \underline{\;4\;} & & & & \\
8388 & & 3015 & & & &
\end{array}
$$

$$
\text{B's portion} = \frac{\overset{1005}{\cancel{3015}} \times \overset{25}{\cancel{17475}}}{\underset{\underset{4}{12}}{\cancel{8388}}} = \frac{25125}{4}s. = £314\ 1s.\ 3d.
$$

$$
\begin{array}{ccccccc}
£ & & £ & s. & & s. & \\
2097 & : & 815 & 15 & :: & 17475 & : \quad \text{C's portion} \\
\underline{\;4\;} & & \underline{\;4\;} & & & & \\
8388 & & 3263 & & & &
\end{array}
$$

$$
\text{C's portion} = \frac{3263 \times \overset{25}{\cancel{17475}}}{\underset{12}{\cancel{8388}}} = \frac{81575}{12}s. = £339\ 17s.\ 11d.
$$

$$
\begin{array}{ccccccc}
£ & & £ & & s. & \\
2097 & : & 1 & :: & 17475 & : \quad \text{dividend}
\end{array}
$$

dividend = $\frac{17475}{2097}$ = $\frac{25}{3}s.$ = 8s. 4d. in the pound

(9)...

		s.	*d.*	*£*	*s.*	*d.*
45 gallons at		15	0	= 33	15	0
63 „	„	17	6	= 55	2	6
75 „	„	18	6	= 69	7	6
183				£158	5	0

183 gallons = 91½ dozen

$$\begin{array}{ccc} £ & s. & d. \end{array}$$

91½ doz. at £2 2s. = 192 3 0

cost 158 5 0

profit £33 18 0

(10)...1 sov. + 3 hf. cr. + 5s. = £1 12s. 6d. = 13 hf. cr.

£81 5s. = 650 hf. cr.

650÷13 = 50

50 sovereigns

50 × 3 = 150 half crowns

50 × 5 = 250 shillings

EXERCISE LXXIX.

			£	*s.*	*d.*
27½	gui.	=	28	17	6
36	sov.	=	36	0	0
43	cr.	=	10	15	0
77	hf. cr.	=	9	12	6
69	fl.	=	6	18	0
237	sh.	=	11	17	0
143	sixp.	=	3	11	6
			£107	11	6

cwt.	qrs.	lb.
(2)...3	2	23½
		6 × 3 =
22	1	1
		3
66	3	3
4		
267		
28		
7479 lb.		

	ac.	ro.	po.		ac.	ro.	po.		£	s.	d.	
(3)...	237	3	20	:	315	1	30	::	523	6	6	:
	4				4				20			
	951				1261				10466			
	40				40				12			
	38060				50470				125598			

$$x = \frac{50470 \times 125598}{38060} = 166551d. = £693\ 19s.\ 3d.$$

(4)...From June 7th to December 20th=196 days=28 weeks

$$
\begin{array}{lrrr}
 & \pounds & s. & d. \\
\text{cost of pig} = & 1 & 5 & 0 \\
\text{28 weeks' keep, at } 2s.\ 3d.\text{ per week} = & 3 & 3 & 0 \\
\text{total cost} = \pounds & 4 & 8 & 0 \\
\end{array}
$$

$$
\begin{array}{lrrr}
 & \pounds & s. & d. \\
\text{235 lb. at } 6\tfrac{1}{2}d.\text{ per lb.} = & 6 & 7 & 3\tfrac{1}{2} \\
 & 4 & 8 & 0 \\
\text{profit} = \pounds & 1 & 19 & 3\tfrac{1}{2} \\
\end{array}
$$

$$
\begin{array}{rl}
\begin{array}{rl}
s.\ \ d. & \\
(5)...10\ \ 0 & = \tfrac{1}{2}\text{ of }\pounds 1 \\
5\ \ 0 & = \tfrac{1}{2}\text{ of }10s. \\
1\ \ 8 & = \tfrac{1}{3}\text{ of }5s. \\
2\tfrac{1}{2} & = \tfrac{1}{8}\text{ of }1s.\ 8d. \\
\tfrac{1}{4} & = \tfrac{1}{10}\text{ of }2\tfrac{1}{2}d. \\
\end{array}
&
\begin{array}{rrr}
\pounds & s. & d. \\
2375 & 0 & 0 = \text{ value at }\pounds 1\text{ each} \\
1187 & 10 & 0 \\
593 & 15 & 0 \\
197 & 18 & 4 \\
24 & 14 & 9\tfrac{1}{2} \\
2 & 9 & 5\tfrac{3}{4} \\
\hline
\pounds 2006 & 7 & 7\tfrac{1}{4} \\
\end{array}
\end{array}
$$

$$
\begin{array}{rl}
\begin{array}{rl}
s.\ \ d. & \\
10\ \ 0 & = \tfrac{1}{2}\text{ of }\pounds 1 \\
5\ \ 0 & = \tfrac{1}{2}\text{ of }10s. \\
2\ \ 6 & = \tfrac{1}{2}\text{ of }5s. \\
1\ \ 3 & = \tfrac{1}{2}\text{ of }2s.\ 6d. \\
\tfrac{1}{2} & = \tfrac{1}{30}\text{ of }1s.\ 3d. \\
\end{array}
&
\begin{array}{rrr}
\pounds & s. & d. \\
5329 & 0 & 0 = \text{ value at }\pounds 1\text{ each} \\
2664 & 10 & 0 \\
1332 & 5 & 0 \\
666 & 2 & 6 \\
333 & 1 & 3 \\
11 & 2 & 0\tfrac{1}{2} \\
\hline
\pounds 5007 & 0 & 9\tfrac{1}{2} \\
\end{array}
\end{array}
$$

$$
\begin{array}{rl}
\begin{array}{rl}
s.\ \ d. & \\
10\ \ 0 & = \tfrac{1}{2}\text{ of }\pounds 1 \\
 & \\
 & \\
3\ \ 4 & = \tfrac{1}{3}\text{ of }10s. \\
4 & = \tfrac{1}{10}\text{ of }3s.\ 4d. \\
\tfrac{1}{2} & = \tfrac{1}{8}\text{ of }4d. \\
\end{array}
&
\begin{array}{rrr}
\pounds & s. & d. \\
1437 & 0 & 0 = \text{ value at }\pounds 1\text{ each} \\
 & & 2 \\
\hline
2874 & 0 & 0 \\
718 & 10 & 0 \\
239 & 10 & 0 \\
23 & 19 & 0 \\
2 & 19 & 10\tfrac{1}{2} \\
\hline
\pounds 3858 & 18 & 10\tfrac{1}{2} \\
\end{array}
\end{array}
$$

(6)...1.

$$5\tfrac{5}{9}\text{ of }6\tfrac{3}{10} = \frac{\overset{5}{\cancel{50}}}{\cancel{9}}\times\frac{\overset{7}{\cancel{63}}}{\cancel{10}} = 35$$

$$6\tfrac{1}{9}-3\tfrac{7}{12} = 6\tfrac{4}{36}-3\tfrac{21}{36} = 2\tfrac{19}{36}$$

$$35\div 2\tfrac{19}{36} = \frac{\overset{5}{\cancel{35}}}{1}\times\frac{36}{\underset{13}{\cancel{91}}} = \frac{180}{13} = 13\tfrac{11}{13}$$

2. $$\frac{4\tfrac{2}{7}}{11\tfrac{2}{3}} = \frac{\frac{30}{7}}{\frac{35}{3}} = \frac{\overset{6}{\cancel{30}}\times 3}{\underset{7}{\cancel{35}}\times 7} = \frac{18}{49}\ ;\quad \frac{1\tfrac{5}{8}}{7\tfrac{2}{9}} = \frac{\frac{13}{8}}{\frac{65}{9}} = \frac{\cancel{13}\times 9}{\underset{5}{\cancel{65}}\times 8} =: \frac{9}{40}\ ;$$

$$\frac{8\tfrac{3}{5}}{7\tfrac{9}{11}} = \frac{\frac{43}{5}}{\frac{86}{11}} = \frac{\cancel{43}\times 11}{\underset{2}{\cancel{86}}\times 5} = \frac{11}{10}$$

$$\therefore\ \frac{4\tfrac{2}{7}}{11\tfrac{2}{3}}-\frac{1\tfrac{5}{8}}{7\tfrac{2}{9}}+\frac{8\tfrac{3}{5}}{7\tfrac{9}{11}} = \frac{18}{19}-\frac{9}{40}+\frac{11}{10}$$

$$= \frac{720-441+2156}{1960}$$

$$= \tfrac{2435}{1960}$$

$$= \tfrac{487}{392} = 1\tfrac{95}{392}$$

3. $$7{\cdot}045 = 7\tfrac{45}{1000} = 7\tfrac{9}{200}\ ;\quad 8{\cdot}0625 = 8\tfrac{625}{10000} = 8\tfrac{1}{16}$$

$$\therefore\quad 7{\cdot}045-5\tfrac{7}{32}+8{\cdot}0625-4\tfrac{11}{20}$$

$$= 7\tfrac{9}{200}-5\tfrac{7}{32}+8\tfrac{1}{16}-4\tfrac{11}{20}$$

$$= 7\tfrac{36}{800}-5\tfrac{175}{800}+8\tfrac{50}{800}-4\tfrac{440}{800}$$

$$= 15\tfrac{86}{800}-9\tfrac{615}{800}$$

$$= 5\tfrac{271}{800} = 5{\cdot}33875$$

(7)...
$$\frac{31}{36}\text{ gui.} = \frac{31}{36} \times \frac{21}{1} = \frac{217}{12} = 18s.\ 1d.$$

$$\frac{27}{40}\text{ hf. cr.} = \frac{27}{40} \times \frac{5}{2} = \frac{27}{16} = 1s.\ 8\tfrac{1}{4}d.$$

sov.
·2875 = 5s. 9d.
20
─────
5·7500s.
12
─────
9·0000d.

fl.
·6875 = 1s. 4½d.
2
─────
1·3750s.
12
─────
4·5000d.
4
─────
2·0000 far.

	£	s.	d.
$\frac{31}{36}$ gui. =	0	18	1
·2875 sov. =	0	5	9
$\frac{27}{40}$ hf. cr. =	0	1	8¼
·6875 flo. =	0	1	4½
	£1	6	10¾

(8)...
  cwt.   cwt.   £

5·6875 : 9·8125 :: 23·8875 : x

$$x = \frac{9\cdot8125 \times 23\cdot8875}{5\cdot6875} = £41\cdot2125 = £41\ 4s.\ 3d.$$

(9)...From March 25 to August 18 = 146 days = $\tfrac{2}{5}$ of a year

4 per cent. = $\frac{1}{25}$ of 100)725 12 6

)29 0 6 = 1 year's int.

      5 16 1⅕
      2

£11 12 2⅖ = 146 days' int.

(10)...

$$\begin{array}{lrr} & \pounds & s. & d. \\ & 166 & 18 & 11\tfrac{1}{2} \text{ amount} \\ & 156 & 13 & 4 \text{ principal} \\ \hline & \pounds 10 & 5 & 7\tfrac{1}{2} \text{ interest} \end{array}$$

$$\begin{array}{l} 2\tfrac{1}{2} \text{ per cent.} = \tfrac{1}{40} \text{ of } 100 \\ 1\tfrac{1}{4} \quad ,, \qquad ,, \quad = \tfrac{1}{2} \text{ of } 2\tfrac{1}{2} \end{array} \left| \begin{array}{rrr} \pounds & s. & d. \\ 156 & 13 & 4 \\ 3 & 18 & 4 \\ 1 & 19 & 2 \\ \hline \pounds 5 & 17 & 6 = 1 \text{ year's int.} \end{array} \right.$$

$$\begin{array}{ccccccccccc} \pounds & s. & d. & & \pounds & s. & d. & & \text{yr.} & & \text{yr.} \\ 5 & 17 & 6 & : & 10 & 5 & 7\tfrac{1}{2} & :: & 1 & : & 1\tfrac{3}{4} \end{array}$$

EXERCISE LXXX.

(1)...

$$\pounds 100 = 48000 \text{ halfpence}$$
$$3s. \; 1\tfrac{1}{2}d. = 75 \text{ halfpence}$$

$$48000 \div 75 = 640 \text{ days} = 1 \text{ year } 275 \text{ days}$$

(2)...

$$22\tfrac{1}{2} \text{ lb.} \times 70 = 1575 \text{ lb.} = 14 \text{ cwt. } 7 \text{ lb.}$$

$$\begin{array}{lrrr} & \pounds & s. & d. \\ & 2 & 13 & 8 \\ & & & 14 \\ \hline & 37 & 11 & 4 \\ 7 \text{ lb.} = & & 3 & 4\tfrac{1}{4} \\ \hline & \pounds 37 & 14 & 8\tfrac{1}{4} \end{array}$$

$$\begin{array}{lrrr} & \pounds & s. & d. \\ 1575 \text{ lb. at } 6\tfrac{1}{2}d. \text{ per lb.} = & 42 & 13 & 1\tfrac{1}{2} \\ \text{cost} = & 37 & 14 & 8\tfrac{1}{4} \\ \hline \text{profit} = & \pounds 4 & 18 & 5\tfrac{1}{4} \end{array}$$

(3)...   3500 eggs at 7 for $6d.$ = 500 sixpences

$$= \pounds 12 \; 10s. \; 0d.$$

3500 eggs at $6s.$ $6d.$ per 100 = $\pounds 11 \; 7s. \; 6d.$

$$\text{profit} = \overline{\pounds 1 \; 2s. \; 6d.}$$

(4)... $\frac{272}{336} \div \frac{16}{18} = \frac{17}{21}$; $\frac{255}{391} \div \frac{17}{17} = \frac{15}{23}$;

$\frac{608}{775} \div \frac{19}{19} = \frac{32}{41}$; $\frac{5005}{7007} \div \frac{1001}{1001} = \frac{5}{7}$

(5)...

$$3\tfrac{5}{9} + 4\tfrac{7}{15} + 7\tfrac{9}{20} + 9\tfrac{13}{25}$$

$$= 23 + \tfrac{5}{9} + \tfrac{7}{15} + \tfrac{9}{20} + \tfrac{13}{25}$$

$$= 23 + \frac{500 + 420 + 405 + 468}{900}$$

$$= 23 + \tfrac{1793}{900} = 23 + 1\tfrac{893}{900}$$

$$= 24\tfrac{893}{900}$$

(6).. $(\tfrac{5}{12} \text{ of } \tfrac{7}{10} \text{ of } 3\tfrac{1}{5}) \times (\tfrac{10}{21} \text{ of } \tfrac{7}{8} \text{ of } 4\tfrac{4}{5})$

$$= \frac{5}{12} \times \frac{7}{10} \times \frac{16}{5} \times \frac{10}{21} \times \frac{7}{8} \times \frac{24}{5}$$

$$= \tfrac{28}{15} = 1\tfrac{13}{15}$$

$(\tfrac{9}{10} \text{ of } \tfrac{7}{15} \text{ of } 7\tfrac{1}{3}) \div (\tfrac{11}{12} \text{ of } \tfrac{21}{20} \text{ of } 3\tfrac{3}{4})$

$$= \frac{9}{10} \times \frac{7}{15} \times \frac{22}{3} \times \frac{12}{11} \times \frac{20}{21} \times \frac{4}{15} = \frac{64}{75}$$

(7)...   April contains 30 days

$$\frac{9}{20} \text{ of 30 days} = \frac{9}{20} \times \frac{30}{1} = \frac{27}{2} = \begin{array}{ccc} \text{da.} & \text{ho.} & \text{min.} \\ 13 & 12 & 0 \end{array}$$

$$\tfrac{11}{18} \text{ week} = \tfrac{11}{18} \times \tfrac{7}{1} = \tfrac{77}{18} = \frac{4}{9} \quad \frac{6}{5} \quad \frac{40}{20}$$

(8)...

	la. w.		la. w.		£	s.	d.		£	s	d
	11×15	:	$13 \times x$	::	103	2	6	:	170	12	
							8				8
					825 hf. cr.				1365 hf. cr		

$$x = \frac{\overset{21}{\cancel{11}} \times \cancel{15} \times \overset{105}{\cancel{1365}}}{\cancel{13} \times \underset{\underset{5}{75}}{\cancel{825}}} = 21 \text{ weeks}$$

(9)...
$$19 + 24 + 29 = 72$$

$$72 \left\{ \begin{array}{l} \quad\quad £ \quad s. \quad d. \\ 6)\overline{26 \quad 5 \quad 0} = 25 \text{ guineas} \\ \text{-}12)\overline{\;4 \quad 7 \quad 6} \end{array} \right.$$

$$7s. \; 3\tfrac{1}{2}d.$$

			£	s.	d.
$7s. \; 3\tfrac{1}{2}d. \times 19$	=		6	18	$6\tfrac{1}{2}$
$7s. \; 3\tfrac{1}{2}d. \times 24$	=		8	15	0
$7s. \; 3\tfrac{1}{2}d. \times 29$	=		10	11	$5\tfrac{1}{2}$
		£	26	5	0

(10)...

$$
\begin{array}{ll}
28879876(5374 & 38254225(6185 \\
25 & 36 \\
103)\overline{387} & 121)\overline{225} \\
\quad 309 & \quad 121 \\
1067)\overline{7898} & 1228)\overline{10442} \\
\quad 7469 & \quad 9824 \\
10744)\overline{42976} & 12365)\overline{61825} \\
\quad 42976 & \quad 61825
\end{array}
$$

EXERCISE LXXXI.

(1)... 1.

	s. d.		£	s.	d.	
	5 0 = $\tfrac{1}{4}$ of £1		1735	0	0	= value at £1
					2	
			3470	0	0	
	2 6 = $\tfrac{1}{2}$ of 5s.		433	15	0	
	3 = $\tfrac{1}{10}$ of 2s. 6d.		216	17	6	
			21	13	9	
		£	4142	6	3	

				£	s.	d.	
2.	1 qr. = ¼ of 1 cwt.			2	16	0	per cwt.
						13	
				36	8	0	
	14 lb. = ½ of 1 qr.				14	0	
	7 lb. = ½ of 14 lb.				7	0	
	3½ lb. = ½ of 7 lb.				3	6	
					1	9	
				£37	14	3	

cwt.	qrs.	lb.			£	s.	d.	
3. 10	0	0	= ½ of 1 ton		9	10	0	per ton
						5 × 10 = 50		
					47	10	0	
							10	
					475	0	0	
2	2	0	= ¼ of 10 cwt.		4	15	0	
1	1	0	= ½ of 2½ cwt.		1	3	9	
		14	= $\frac{1}{10}$ of 1¼ cwt.			11	10½	
						1	2¼	
					£481	11	9¾	

s.	d.			£	s.	d.		yds.
4. 2	6	= ⅛ of £1		2347	0	0	= value of 2347 at £1	
1	3	= ½ of 2s. 6d.		293	7	6		
	1	= $\frac{1}{15}$ of 1s. 3d.		146	13	9		
				9	15	7		
4 sq. ft. 72 sq. in. =				0	1	11		
1 sq. ft. 18 sq. in. =				0	0	5¾		
				£449	19	2¾		

2)...

$$1 \text{ mile} = 1760 \text{ yards}$$
$$16\frac{1}{4}$$
$$28160$$
$$440$$
$$5720\overline{)28600}(5 \text{ yards}$$
$$28600$$

(3)...

E. ells	qrs.	na.		yds.	qr.	na.		£	s.	d.
29	3	2	:	47	1	3	::	6	3	9
5				4				20		
148				189				123		
4				4				12		
594				759				1485		

$$x = \frac{759 \times \overset{5}{\cancel{1485}}}{\underset{2}{\cancel{594}}} = \frac{3795}{2}d. = £7 \ 18s. \ 1\tfrac{1}{2}d.$$

(4)...

$$
\begin{array}{rr}
s. & d. \\
38 & 8 \\
 & 9 \\
\hline
348 & 0 \\
12 & \\
\hline
4176 &
\end{array}
$$

$$3s. \ 7\tfrac{1}{2}d. \overset{hf.\,d. \quad 2}{= 87)\overline{8352}}(96 \text{ lb.}$$

$$
\begin{array}{r}
783 \\
\hline
522 \\
522 \\
\hline
\end{array}
$$

(5)...

1. $(7\cdot345 - 8\cdot944145 + 4\cdot06525) \div \cdot057$

    $= \ 2\cdot466105 \div \cdot057$

    $= \ 43\cdot265$

2. $(791\cdot0981 \div 38\cdot515) \times \cdot00725$

    $= 20\cdot54 \times \cdot00725$

    $= \cdot148915$

(6)...

$$\frac{9}{10} \text{ fur.} = \frac{9}{\cancel{10}} \times \frac{\overset{22}{\cancel{220}}}{1} = \overset{\text{yds.}}{198}$$

$$\frac{3}{40} \text{ mi.} = \frac{3}{40} \times \frac{\overset{44}{\cancel{1760}}}{1} = 132$$

$$\underline{66} \text{ yards}$$

(7)...

$$20)\overset{s.}{2\cdot075}$$

$$\overline{\cdot10375} \text{ of a sov.}$$

(8)...
$$46090\overset{.}{5}2\overset{.}{1}(6789$$
$$36$$
$$127)\overline{1009}$$
$$889$$
$$1348)\overline{12005}$$
$$10784$$
$$13569)\overline{122121}$$
$$122121$$

$$975353\overset{.}{7}\overset{.}{6}(9876$$
$$81$$
$$188)\overline{1653}$$
$$1504$$
$$1967)\overline{14953}$$
$$13769$$
$$19746)\overline{118476}$$
$$118476$$

(9)...
$$\overset{ac.}{7\tfrac{5}{12}} \; : \; \overset{ac.}{19\tfrac{11}{16}} \; :: \; \overset{£}{15\tfrac{23}{40}} \; : \; x$$

$$x = \overset{3}{\cancel{\underset{89}{12}}} \times \overset{63}{\cancel{\underset{\underset{4}{16}}{315}}} \times \overset{7}{\cancel{\underset{\underset{8}{40}}{623}}} = £\frac{1323}{32} = £41 \; 6s. \; 10\tfrac{1}{2}d.$$

(10)...
$$\begin{array}{ll} £ \quad s. \\ 393 \quad 0 & \text{amount} \\ 327 \quad 10 & \text{principal} \\ \hline £65 \quad 10 & \text{interest} \end{array}$$

$$5 \text{ per cent.} = \tfrac{1}{20} \text{ of } 100)\overset{£ \quad s. \quad d.}{327 \quad 10 \quad 0}$$
$$£16 \quad 7 \quad 6 \text{ interest for 1 year}$$

$$\begin{array}{ccccccccc} £ & s. & d. & & £ & s. & & \text{yr.} & & \text{yrs.} \\ 16 & 7 & 6 & : & 65 & 10 & :: & 1 & : & 4 \end{array}$$

EXERCISE LXXXII.

(1)...
cwt.	qrs.	lb.		cwt.	qr.	lb.		£	s.	d.		
7	2	18	:	9	1	25	::	8	18	9	:	x
4				4				20				
30				37				178				
28				28				12				
858				1061				2145				

$$x = \frac{1061 \times \overset{5}{\cancel{2145}}}{\cancel{\underset{2}{858}}} = \frac{5305}{2}d. = £11 \; 1s. \; 0\tfrac{1}{2}d.$$

N

(2)...

$$
\begin{array}{r}
£ \quad s. \quad d. \\
28 \quad 4 \quad 4\tfrac{1}{2} \\
20 \\
\overline{564} \\
12 \\
7)\overline{67772\tfrac{1}{2}} \\
\overline{967\tfrac{1}{2}} = £967 \ 10s.
\end{array}
$$

(3)...   1 cwt. 2 qrs. 12 lb. × 75 = 180 lb. × 75 = 13500 lb.

$$
\begin{array}{ll}
1s. \ 3d. = \tfrac{1}{16} \text{ of } £1 &
\begin{array}{|rrr}
£ \quad & s. & d. \\
13500 & 0 & 0 = \text{value at } £1 \text{ per lb.} \\
\cline{1-3}
843 & 15 & 0 \\
28 & 2 & 6 \\
\cline{1-3}
£871 & 17 & 6
\end{array} \\
\tfrac{1}{2}d. = \tfrac{1}{30} \text{ of } 1s. \ 3d.
\end{array}
$$

(4)...

$$
\begin{array}{r}
\text{I. mi.} \\
11 \ : \ 14 \ :: \ 113 \\
14 \\
11)\overline{1582} \\
\overline{143 \text{ mi. 6 fur. 120 yds.}}
\end{array}
$$

(5)...   1 cwt. 2 qrs. 17½ lb. × 1250 = 103 t. 10 cwt. 1 qr. 7 lb.

$$
\begin{array}{ll}
10 \text{ cwt.} = \tfrac{1}{2} \text{ of } 1 \text{ ton} &
\begin{array}{|rrr}
£ \quad & s. & d. \\
4 & 15 & 0 \text{ per ton} \\
& & 10 \times 10 + 3 = 103 \\
\cline{1-3}
47 & 10 & 0 \\
& & 10 \\
\cline{1-3}
475 & 0 & 0 \\
14 & 5 & 0 \\
2 & 7 & 6 \\
\end{array} \\
1 \text{ qr.} = \tfrac{1}{40} \text{ of } 10 \text{ cwt.} &
\begin{array}{rrr}
0 & 1 & 2\tfrac{1}{4} \\
0 & 0 & 3\tfrac{9}{16} \\
\cline{1-3}
£491 & 13 & 11\tfrac{13}{16}
\end{array} \\
7 \text{ lb.} = \tfrac{1}{4} \text{ of } 1 \text{ qr.}
\end{array}
$$

(6)...

	£	s.	d.
	23	1	8
	18	9	4

£4 12 4 = profit by sale of $34\frac{5}{8}$ yards

yds.		yd.		£	s.	d.		
$34\frac{5}{8}$	:	1	::	4	12	4	:	gain per yard
8		8		20				
277		8		92				
				12				
				1108				

$$\text{gain per yard} = \frac{8 \times \cancel{1108}^{4}}{\cancel{277}} = 32d. = 2s.\ 8d.$$

(7)...

	£	s.	d.	
	805	9	2	amount
	619	11	8	principal
	£185	17	6	interest

$2\frac{1}{2}$ per cent. $= \frac{1}{40}$ of 100

$1\frac{1}{4}$ „ $= \frac{1}{2}$ of $2\frac{1}{2}$

£	s.	d.
619	11	8
15	9	$9\frac{1}{2}$
7	14	$10\frac{3}{4}$
£23	4	$8\frac{1}{4}$ = interest for 1 year

£	s.	d.		£	s.	d.		yr.		yrs.
23	4	$8\frac{1}{4}$	:	185	17	6	::	1	:	8

(8)... Amount of £100 in $5\frac{1}{4}$ yrs. at $4\frac{1}{2}$ per cent. per annum

$= £100 + (£4\ 10s. \times 5\frac{1}{4}) = £123\ 12s.\ 6d.$

£	s.	d.		£	s.	d.		£		
123	12	6	:	585	3	2	::	100	:	£473 6s. 8d.

$$(9)... \quad \overset{\text{men wks.}}{18 \times 16 \times 1} \; : \; \overset{\text{men wks.}}{24 \times x \times \frac{4}{5}} \; :: \; \overset{\text{ca. lb.}}{42 \times 60} \; : \; \overset{\text{ca. lb.}}{48 \times 70}$$

$$x = \frac{\overset{6}{\cancel{18}} \times \overset{20}{\cancel{16}} \times \overset{2}{\cancel{48}} \times \overset{5}{\cancel{70}}}{\underset{\underset{3}{\cancel{24}} \times \underset{\cancel{5}}{\cancel{5}} \times \underset{\cancel{42}}{\cancel{42}} \times \underset{\underset{10}{\cancel{60}}}{\cancel{60}}} = 20 \text{ weeks}$$

(10)... If x = no. of votes for successful candidate

$$\left.\begin{array}{c} x - 269 \\ x - 313 \\ x - 857 \end{array}\right\} = \text{nos. for the other candidates}$$

Now $\overline{4x - 1439}$ = 7949

∴ $4x = 7949 + 1439 = 9388$

and $x = 2347$, no. for successful candidate

$$x - 269 = 2347 - 269 = 2078$$
$$x - 313 = 2347 - 313 = 2034$$
$$x - 857 = 2347 - 857 = 1490$$

EXERCISE LXXXIII.

				s.	d.	£	s.	d.
(1)...	13	yds.	Cotton Sheeting......	1	4½	= 0	17	10½
	19½	„	Linen do.	2	5	= 2	7	1½
	2	prs.	Blankets	16	6	= 1	13	0
	3	„	do.	18	9	= 2	16	3
	3	„	Counterpanes	17	6	= 2	12	6
						£10	6	9

			£	s.	d.	
(2)...	2 ro.	= ½ of 1 ac.	2	16	0	per acre
				11		
			30	16	0	
				11		
			338	16	0	
	1 ro.	= ½ of 2 ro.	1	8	0	
	20 per.	= ½ of 1 ro.	0	14	0	
	5 per.	= ¼ of 20 per.	0	7	0	
			0	1	9	
			£341	6	9	

(3)... $1560 + 1780 + 2350 + 2620 + 3030 + 5740 = 17080$

$$17080 \;:\; 1560 \;::\; \overset{£}{2135} \;:\; \overset{£ \quad s.}{195 \;\; 0} \quad A$$

$$17080 \;:\; 1780 \;::\; \overset{£}{2135} \;:\; \overset{£ \quad s.}{222 \;\; 10} \quad B$$

$$17080 \;:\; 2350 \;::\; \overset{£}{2135} \;:\; \overset{£ \quad s.}{293 \;\; 15} \quad C$$

$$17080 \;:\; 2620 \;::\; \overset{£}{2135} \;:\; \overset{£ \quad s.}{327 \;\; 10} \quad D$$

$$17080 \;:\; 3030 \;::\; \overset{£}{2135} \;:\; \overset{£ \quad s.}{378 \;\; 15} \quad E$$

$$17080 \;:\; 5740 \;::\; \overset{£}{2135} \;:\; \overset{£ \quad s.}{717 \;\; 10} \quad F$$

(4)...
$$\frac{\frac{3}{7}}{\frac{5}{8}} = \frac{3 \times 8}{5 \times 7} = \frac{24}{35}; \qquad \frac{7\frac{5}{6}}{9} = \frac{\frac{47}{6}}{\frac{9}{1}} = \frac{47}{9 \times 6} = \frac{47}{54};$$

$$\frac{11}{12\frac{4}{7}} = \frac{\frac{11}{1}}{\frac{88}{7}} = \frac{11 \times 7}{88} = \frac{7}{8}; \qquad \frac{7\frac{5}{9}}{12\frac{7}{8}} = \frac{\frac{68}{9}}{\frac{103}{8}} = \frac{68 \times 8}{103 \times 9} = \frac{544}{927}$$

(5)...
$$\tfrac{7}{12} \times 2\tfrac{5}{8} \times 4\tfrac{1}{2} \times 3\tfrac{4}{7} \times \tfrac{11}{14} \times 5\tfrac{1}{4} \times 1\tfrac{3}{5} \times 3\tfrac{5}{9} \times \tfrac{8}{21} \times \tfrac{1}{5}$$

$$= \frac{7}{12} \times \frac{21}{8} \times \frac{9}{2} \times \frac{25}{7} \times \frac{11}{14} \times \frac{21}{4} \times \frac{8}{5} \times \frac{32}{9} \times \frac{8}{21} \times \frac{1}{5}$$

$$= 44$$

(6)...

$$\frac{7}{18}\text{ gui. } = \frac{7}{18}\times\frac{21}{1} = \frac{49}{6} = \begin{matrix}£ & s. & d.\\ 0 & 8 & 2\end{matrix}$$

$$\frac{19}{24}\text{ sov. } = \frac{19}{24}\times\frac{20}{1} = \frac{95}{6} = 0\ \ 15\ \ 10$$

$$\frac{7}{8}\text{ cro. } = \frac{7}{8}\times\frac{5}{1} = \frac{35}{8} = 0\ \ 4\ \ 4\tfrac{1}{2}$$

$$\frac{9}{16}\text{ fl. } = \frac{9}{16}\times\frac{2}{1} = \frac{9}{8} = 0\ \ 1\ \ 1\tfrac{1}{2}$$

$$\tfrac{3}{8} = \frac{0\ \ \ 0\ \ \ 4\tfrac{1}{2}}{£1\ \ \ 9\ \ \ 10\tfrac{1}{2}}$$

$$\begin{array}{l}4)\ 2\\ 12)\overline{10\cdot5}\\ 40)\overline{29\cdot875}\end{array}$$

£1.9s 10½d. = ·746875 of a double sov.

(7)...

$$\frac{19}{32}\text{ ton } = \frac{19}{32}\times\frac{20}{1} = \frac{95}{8} = \begin{matrix}\text{cwt.} & \text{qrs.} & \text{lb.}\\ 11 & 3 & 14\end{matrix}$$

$$\tfrac{13}{16} = \frac{0\ \ \ 3\ \ \ 7}{\text{cwt. }12\ \ \ 2\ \ \ 21\text{ lb.}}$$

$$\frac{7}{16}\text{ acre } = \frac{7}{16}\times\frac{4}{1} = \frac{7}{4} = \begin{matrix}\text{ro.} & \text{per.}\\ 1 & 30\end{matrix}$$

$$\tfrac{13}{20} = \frac{0\ \ \ 26}{\text{ro. }1\ \ \ 4\text{ per.}}$$

(8)...

19 hrs. 22½ min. = 2325 half minutes

1 day = 2880 „

$$\frac{2325}{2880} - \frac{15}{15} = \frac{155}{192}\text{ of a day}$$

3 days 10 hrs. 30 min. = 4950 minutes

1 week = 10080 „

$$\frac{4950}{10080} \div \frac{90}{90} = \frac{55}{112}\text{ of a week}$$

(9)...
$$5041863396\overset{...}{9664}(7100608$$
$$49$$
$$141)\overline{\;141\;}$$
$$141$$
$$142006)\overline{\quad863396}$$
$$852036$$
$$14201208)\overline{\;113609664}$$
$$113609664$$

(10)...

£		£		£		£	s.	
10000	:	3500	::	1250	:	437	10,	A's share
10000	:	4250	::	1250	:	531	5,	B's share
10000	:	2250	::	1250	:	281	5,	C's share

EXERCISE LXXXIV.

(1)...
$$\tfrac{2597}{3445} \div \tfrac{53}{55} = \tfrac{49}{65}; \quad \tfrac{6715}{8927} \div \tfrac{79}{79} = \tfrac{85}{113}$$

$$2)5\;\;6\;\;7\;\;8\;\;9\;\;10\;\;15\;\;20$$
$$2)\overline{5\;\;3\;\;7\;\;4\;\;9\;\;5\;\;15\;\;10}$$
$$3)\overline{5\;\;3\;\;7\;\;2\;\;9\;\;5\;\;15\;\;5}$$
$$5)\overline{5\;\;1\;\;7\;\;2\;\;8\;\;5\;\;5\;\;5}$$
$$\overline{1\;\;1\;\;7\;\;2\;\;3\;\;1\;\;1\;\;1}$$

L.C.M. $= 2 \times 2 \times 3 \times 5 \times 7 \times 2 \times 3 = 2520$

(2)...
$$\left(\tfrac{9}{14} \text{ of } \tfrac{17}{27} \text{ of } 8\tfrac{8}{9}\right) \times \left(\tfrac{7}{17} \text{ of } \tfrac{11}{15} \text{ of } 22\tfrac{1}{11}\right)$$

$$= \frac{9}{14} \times \frac{17}{27} \times \frac{80}{9} \times \frac{7}{17} \times \frac{11}{15} \times \frac{243}{11}$$

$$= 24$$

$$\left(\tfrac{13}{18} \text{ of } \tfrac{25}{36} \text{ of } 14\tfrac{2}{5}\right) \div \left(\tfrac{10}{11} \text{ of } 2\tfrac{1}{5} \text{ of } 9\tfrac{3}{4}\right)$$

$$= \frac{13}{18} \times \frac{25}{36} \times \frac{72}{5} \times \frac{11}{10} \times \frac{9}{22} \times \frac{4}{39}$$

$$= \tfrac{1}{3}$$

(3)...
$$\frac{5}{18} \text{ hf. gui.} = \frac{5}{\cancel{18}_{6}} \times \frac{\cancel{21}^{7}}{2} = \frac{35}{12} = \overset{s.\ \ d.}{2\ \ 11}$$

$$\tfrac{9}{16}\text{ crown} = \tfrac{9}{16} \times \tfrac{4}{1} = \tfrac{45}{16} = \overset{}{2\ \ 9\tfrac{3}{4}}$$
$$\text{difference} = \overline{\quad 1\tfrac{1}{4}d.}$$

(4)...
$$3 \text{ fur. } 132 \text{ yds.} = 792 \text{ yards}$$
$$1 \text{ mile} = 1760 \text{ yards}$$

$$\tfrac{792}{1760} \div \tfrac{88}{88} = \tfrac{9}{20} \text{ of a mile.}$$

1 rood 27 per. 15⅛ sq. yds. = 16335 eighths of a sq. yd.
$$1 \text{ acre} = 38720 \quad ,, \qquad ,,$$
$$\tfrac{16335}{38720} \div \tfrac{605}{605} = \tfrac{27}{64} \text{ of an acre}$$

(5)...
$$16)\overline{11}$$
$$\cdot 6875$$

$$64\begin{cases} 8)\overline{21} \\ 8)\overline{\ 2\cdot 625} \end{cases}$$
$$\cdot 328125$$

$$50)\overline{29}$$
$$\cdot 58$$

$$512\begin{cases} 8)\overline{77} \\ 8)\overline{\ 9\cdot 625} \\ 8)\overline{\ 1\cdot 203125} \end{cases}$$
$$\cdot 150390625$$

(6)...
$$12)\underline{\ \ 6}$$
$$3)\overline{\ \ 1\cdot 5}$$
$$220)\overline{192\cdot 5}$$
$$8)\overline{\ \ 3\cdot 875}$$

3 fur. 192 yds. 1 ft. 6 in. =   ·484375 of a mile

(7)...
$$\overset{\text{cwt.}}{7\cdot 21875}$$
$$1\cdot 0625\pounds \text{ per cwt.}$$
$$\overline{3609375}$$
$$1443750$$
$$4331250$$
$$721875$$
$$\pounds\overline{7\cdot 669921875} = \pounds 7 \text{ } 13s. \text{ } 4\tfrac{31}{32}d.$$
$$\underline{20}$$
$$\overline{13\cdot 398437500s.}$$
$$\underline{12}$$
$$\overline{4\cdot 781250000d.} = 4\tfrac{25}{32}d.$$

(8)...
$$2\tfrac{1}{2} + 3\tfrac{1}{2} + 4\tfrac{1}{2} + 7\tfrac{1}{2} = 18$$

£64 16s. ÷ 18 = £3 12s.

£3 12s. × 2½ = £9
£3 12s. × 3½ = £12 12s.
£3 12s. × 4½ = £16 4s.
£3 12s. × 7½ = £27

(9)... 4 per cent. = $\frac{1}{25}$ of 100

½   „   = ⅛ of 4

	£	s.	d.
	367	10	0 = 350 guineas
	14	14	0
	1	16	9

£16 10 9 int. for 1 year

3¾

49 12 3

½ year = 8 5 4½
¼ „ = 4 2 8¼

£62 0 3¾ int. for 3¾ years

(10)...

£	s.		£	s.		£	s.	
72	5	:	7658	10	::	3	10	: Annual income
4			4			20		
289			30634			70s.		

Annual income $= \dfrac{\overset{106}{\cancel{30634}} \times 70}{\underset{\cancel{289}}{\cancel{289}}} = 7420s. = £371$

EXERCISE LXXXV.

(1)...
10 t. 17 cwt. = 388864 ounces
3 cwt. 1 qr. 15 lb. 12 oz. = 6076 ounces
388864 ÷ 6076 = 64 times

(2)...

			s.	d.	£	s.	d.
53½	yds.	Brussels Carpeting	4	3 =	11	7	4½
36½	„	Kidderminster do.	2	11 =	5	7	2¼
10¼	„	Drugget	2	9 =	1	8	10½
15¾	„	Matting...................	1	9 =	1	7	6¾
					£19	11	0

(3)... 175 qrs. Wheat......48 6 = 424 7 6

                          350 guineas = 367 10 0

$$42 \begin{cases} 6) & \overline{56 \quad 17 \quad 6} \text{ value of oats} \\ 7) & \overline{9 \quad 9 \quad 7} \end{cases}$$

∴ the oats were reckoned at £1 7 1 per quarter

(4)...
$$1° \quad : \quad 2° \, 54' \quad :: \quad \overset{\text{min.}}{4} \quad : \quad x$$

$$\begin{array}{cc} 60 & 60 \\ \hline 60 & \overline{174} \end{array}$$

$$x = \frac{174 \times 4}{60} = \frac{174}{15} \text{ min.} = 11 \text{ min. } 36 \text{ sec.}$$

Time at Chester = 12 hrs. −11 min. 36 sec.

                = 11 hrs. 48 min. 24 sec. A.M.

(5)...
$$\overset{\text{min.}}{4} \quad : \quad \overset{\text{min. sec.}}{11 \quad 56} \quad :: \quad 1^b \quad : \quad \text{lon. of Liverpool}$$

$$\begin{array}{cc} 60 & 60 \\ \hline 240 & \overline{716} \end{array}$$

Longitude of Liverpool $= \frac{716}{240} = \frac{179}{60} = 2° \, 59' \text{ W}$

(6)...
$$\tfrac{7}{8} + \tfrac{5}{9} - \tfrac{2}{5} + \tfrac{3}{7} - \tfrac{5}{6} + \tfrac{3}{4}$$

$$= \frac{2205 + 1400 - 1008 + 1080 - 2100 + 1890}{2520}$$

$$= \tfrac{6575}{2520} - \tfrac{3108}{2520} = \tfrac{3467}{2520} = 1\tfrac{947}{2520}$$

(7)...
$$51\tfrac{1}{3} \div \left(\tfrac{7}{11} \text{ of } \tfrac{9}{14} \text{ of } 14\tfrac{2}{3} \right)$$

$$= \frac{\cancel{154}^{7}}{\cancel{3}} \times \frac{11}{7} \times \frac{\cancel{14}^{7}}{9} \times \frac{\cancel{9}}{\cancel{44}_{\cancel{2}}} = \frac{77}{9} = 8\tfrac{5}{9}.$$

(8)...   267·832)79·4260000(·2965......
$$\begin{array}{r}535664 \\ \hline 2585960 \\ 2410488 \\ \hline 1754720 \\ 1606992 \\ \hline 1477280 \\ 1339160 \\ \hline 138120 \end{array}$$

(9)...   4)3   40)35

       12)9·75   4) 3·875

      20)7·8125   3 ro. 35 per. = ·96875 of an acre

7s. 9¾d. = ·390625 of a sov.

(10)...
$$\sqrt{\tfrac{49}{121}} = \tfrac{7}{11}$$
$$\sqrt{4\tfrac{29}{49}} = \sqrt{\tfrac{225}{49}} = \tfrac{15}{7} = 2\tfrac{1}{7}$$
$$\sqrt{54\tfrac{25}{64}} = \sqrt{\tfrac{3481}{64}} = \tfrac{59}{8} = 7\tfrac{3}{8}$$
$$\sqrt{179\tfrac{11}{25}} = \sqrt{\tfrac{4489}{25}} = \tfrac{67}{5} = 13\tfrac{2}{5}$$

EXERCISE LXXXVI.

(1)...
$$\begin{array}{ccc} £ & s. & d. \\ 615 & 17 & 11 \\ & 20 & \end{array}$$

7814)12317(1s. 6$\frac{7163}{7814}$d.
$$\begin{array}{r}7814 \\ \hline 4503 \\ 12 \end{array}$$

7814)54047(6d.
$$\begin{array}{r}46884 \\ \hline 7163 \\ 7814 \end{array}$$

(2)...25 qrs. 2 bu. 2 pks. at 28s. per quarter = £35 8s. 9d.

£35 8s. 9d. ÷ 4½ gui. = 7½ tons

(3)...$\frac{17}{50}$ sq. mile $= \frac{17}{50}$ of 640 ac. $= 217\frac{3}{5}$ ac. $= 217$ ac. 2ro. 16 per.

(4)...

$$2\cdot 37 \quad : \quad \cdot065 \quad :: \quad 40\cdot 29 \quad$$
$$ 17 17$$
$$ \overline{455}$$
$$ 65$$
$$ \overline{1\cdot 105}$$

(5)...

$$\begin{array}{ccccccc} \text{men da.} & & \text{men da.} & & \text{ac.} & & \\ 9\times 8 & : & 6\times 7 & :: & 27 & : & x \end{array}$$

$$x = \frac{\overset{3}{\cancel{6}}\times 7 \times \overset{3}{\cancel{27}}}{\underset{4}{\cancel{9}\times \cancel{8}}} = \frac{63}{4} \text{ ac.} = 15\frac{3}{4} \text{ acres}$$

(6)...

$$\begin{array}{ccccccc} \pounds \;\; \text{yrs.} & & \pounds \;\; \text{yrs.} & & \pounds \;\; s. & & \\ 160\times 2\frac{1}{4} & : & 250\times 3\frac{1}{2} & :: & 13 \;\; 10 & : & x \\ 4 & & 4 & & 20 & & \\ \overline{9} & & \overline{14} & & \overline{270} & & \end{array}$$

$$x = \frac{\overset{25}{\cancel{250}}\times \overset{7}{\cancel{14}} \times \overset{\overset{15}{\cancel{30}}}{\cancel{270}}}{\underset{\underset{\underset{4}{\cancel{8}}}{\cancel{16}}}{\cancel{160}\times \cancel{9}}} = 2625s. = \pounds 32 \;\; 16s. \;\; 3d.$$

(7)...

$$\begin{array}{c} 100 \\ 16 \\ \overline{116} \end{array}$$

$$\begin{array}{ccccc} & & & \pounds \;\; s. \;\; d. & \\ \overline{116} & : & 100 & :: & 2 \;\; 3 \;\; 6 \quad : \quad \text{prime cost} \\ & & & 20 & \\ & & & \overline{43} & \\ & & & 12 & \\ & & & \overline{522} & \end{array}$$

$$\text{prime cost} = \frac{\overset{25}{\cancel{100}}\times \overset{18}{\cancel{522}}}{\underset{4}{\cancel{116}}} = 450d. = \pounds 1 \;\; 17s. \;\; 6d. \text{ per cwt.}$$

(8)... profit per cwt. $= £3$ $10s. - £3$ $2s.$ $6d.$ $= 7s.$ $6d.$

$$
\begin{array}{ccccccccc}
£ & s. & d. & & s. & d. & & & \\
3 & 2 & 6 & : & 7 & 6 & :: & 100 & : \quad 12 \text{ per cent.}
\end{array}
$$

(9)... Loss $= 100 - 87\frac{1}{2} = 12\frac{1}{2} = \frac{1}{8}$ of value

$$
\begin{array}{rrrl}
£ & s. & d. & \\
8)12500 & 0 & 0 & \\
\hline
16)1562 & 10 & 0 & \text{loss on ship} \\
\hline
97 & 13 & 1\frac{1}{2} & \\
 & & 3 & \\
\hline
£292 & 19 & 4\frac{1}{2} & \\
\hline
\end{array}
$$

(10)...

$$
\begin{array}{r}
1769{\cdot}0436(42{\cdot}06 \\
16 \\
\hline
82) \; 169 \\
164 \\
\hline
8406) \quad 50436 \\
50436 \\
\hline
\end{array}
$$

EXERCISE LXXXVII.

(1)...

$$
\begin{array}{rrrl}
£ & s. & d. & \\
1. \quad 64 & 0 & 0 & \text{per acre} \\
& & & 7 \times 8 + 1 = 57 \\
\hline
448 & 0 & 0 & \\
& & 8 & \\
\hline
3584 & 0 & 0 & \\
\end{array}
$$

	£	s.	d.
2 roods $= \frac{1}{2}$ of 1 ac.	64	0	0
1 rood $= \frac{1}{2}$ of 2 ro.	32	0	0
20 per. $= \frac{1}{2}$ of 1 ro.	16	0	0
5 per. $= \frac{1}{4}$ of 20 per.	8	0	0
2$\frac{1}{2}$ per. $= \frac{1}{2}$ of 5 per.	2	0	0
	1	0	0

$$
\begin{array}{rrr}
\hline
£3707 & 0 & 0 \\
\hline
\end{array}
$$

2.   2 qrs. = ½ of 1 cwt.

$$
\begin{array}{ccc}
\pounds & s. & d. \\
3 & 3 & 0 \text{ per cwt.}
\end{array}
$$

$$9 \times 12 + 5 = 113$$

$$
\begin{array}{rrr}
28 & 7 & 0 \\
 & & 12 \\
\hline
340 & 4 & 0 \\
15 & 15 & 0 \\
1 & 11 & 6 \\
 & 7 & 10\tfrac{1}{2} \\
 & 2 & 3 \\
\hline
\pounds 358 & 0 & 7\tfrac{1}{2}
\end{array}
$$

14 lb. = ¼ of 2 qrs.

4 lb. = $\frac{1}{14}$ of 2 qrs.

3.

$$
\begin{array}{ccc}
\pounds & s. & d. \\
2 & 2 & 8 \text{ per quarter}
\end{array}
$$

$$4 \times 7 + 1 = 29$$

$$
\begin{array}{rrr}
8 & 10 & 8 \\
 & & 7 \\
\hline
59 & 14 & 8 \\
2 & 2 & 8 \\
1 & 1 & 4 \\
 & 5 & 4 \\
 & 2 & 8 \\
 & & 8 \\
 & & 4 \\
 & & 2 \\
\hline
\pounds 63 & 7 & 10
\end{array}
$$

4 bu. = ½ of 1 qr.
1 bu. = ¼ of 4 bu.
2 pks. = ½ of 1 bu.
1 gal. = ¼ of 2 pks.
2 qts. = ¼ of 1 gal.
1 qt. = ½ of 2 qts.

(2)...

$$\left(\tfrac{5}{9} \text{ of } 6\tfrac{3}{4}\right) - \left(\tfrac{4}{7} \text{ of } 3\tfrac{1}{9}\right)$$

$$= \left(\frac{5}{9} \times \frac{\overset{3}{\cancel{27}}}{4}\right) - \left(\frac{4}{7} \times \frac{\overset{4}{\cancel{28}}}{9}\right)$$

$$= \frac{15}{4} - \frac{16}{9} = \frac{135-64}{36} = \frac{71}{36} = 1\tfrac{35}{36}$$

$(3)\dots$

$$\frac{7\frac{3}{5}-2\frac{5}{6}}{8\frac{1}{3}+7\frac{2}{5}}=\frac{7\frac{18}{30}-2\frac{25}{30}}{8\frac{5}{15}+7\frac{6}{15}}=\frac{4\frac{23}{30}}{15\frac{11}{15}}=\frac{\frac{143}{30}}{\frac{236}{15}}=\frac{143}{472};$$

$$\frac{4\frac{1}{5}\times2\frac{6}{7}}{8\frac{1}{4}+1\frac{2}{9}}=\frac{\dfrac{\overset{3}{\cancel{21}}}{\cancel{5}}\times\dfrac{\overset{4}{\cancel{20}}}{7}}{\dfrac{\cancel{33}}{4}\times\dfrac{9}{\cancel{11}}}=\frac{\dfrac{12}{27}}{\dfrac{27}{4}}=\frac{\overset{4}{\cancel{12}}\times4}{\underset{9}{\cancel{27}}}=\frac{16}{9}=1\frac{7}{9}$$

$(4)\dots$

$$\frac{17}{32}\text{ sov.}=\frac{17}{\underset{8}{\cancel{32}}}\times\frac{\overset{5}{\cancel{20}}}{1}=\frac{85}{8}=\overset{s.}{10}\ \ \overset{d.}{7\frac{1}{2}}$$

$$\frac{11}{28}\text{ gui.}=\frac{11}{\underset{4}{\cancel{28}}}\times\frac{\overset{3}{\cancel{21}}}{1}=\frac{33}{4}=\frac{8\quad3}{2s.\ \ 4\frac{1}{2}d.}$$

$(5)\dots$

$$\frac{13}{21}\text{ mo.}=\frac{13}{\underset{3}{\cancel{21}}}\times\frac{\overset{4}{\cancel{28}}}{1}=\frac{52}{3}\text{ da.}=\overset{\text{da. hrs. min.}}{17\ \ \ 8\ \ \ 0}$$

$$\frac{17}{24}\text{ week}=\frac{17}{24}\times\frac{7}{1}=\frac{119}{24}\text{ da.}=\ \ 4\ \ 23\ \ \ 0$$

$$\frac{11}{88}\text{ da.}=\frac{11}{\underset{3}{\cancel{88}}}\times\frac{\overset{4}{\cancel{24}}}{1}=\frac{44}{3}\text{ ho.}=\ \ \ 14\ \ 40$$

$$\frac{9}{20}\text{ hour}=\frac{9}{\cancel{20}}\times\frac{\overset{3}{\cancel{60}}}{1}=27\text{ min.}=\underset{\text{days}\ \ 22\ \ 22\ \ 7\text{ min.}}{\overline{\qquad\qquad27\qquad}}$$

(6)... $\qquad$ A can do $\frac{1}{12}$ in 1 day

$\qquad\qquad\qquad$ B can do $\frac{1}{15}$ in 1 day

A + B can do $\frac{1}{12} + \frac{1}{15} = \frac{5}{60} + \frac{4}{60} = \frac{9}{60} = \frac{3}{20}$ in 1 day

∴ together they would complete the work in $\frac{20}{3} = 6\frac{2}{3}$ days

(7)... $\qquad\qquad\qquad \frac{13}{30} + \frac{1}{5} = \frac{13}{30} + \frac{6}{30} = \frac{19}{30}$

$\qquad\qquad 1 - \frac{19}{30} = \frac{11}{30}$ which is = £2750

$$\frac{11}{30} \; : \; 1 \; :: \; \overset{£}{2750} \; : \; \overset{£}{7500}$$

(8)...
$$
\begin{array}{ccc}
£ & s. & d. \\
495 & 2 & 2 \text{ amount} \\
419 & 11 & 8 \text{ principal} \\
\hline
£75 & 10 & 6 \text{ int. for } 4\frac{1}{2} \text{ years}
\end{array}
$$

£75 10s. 6d. ÷ 4½ = £16 15s. 8d., int. for 1 year

$$
\begin{array}{ccc}
£ \quad s. \quad d. & & £ \qquad\qquad £ \quad s. \quad d. \\
419 \quad 11 \quad 8 \; : \; 100 \; :: \; 16 \quad 15 \quad 8 \; : \; 4 \text{ per cent.}
\end{array}
$$

(9)...   Amount of £100 in 5½ years at 4½ per cent.

$\qquad\qquad$ = £100 + (£4 10s. × 5½) = £124 15s.

$$
\begin{array}{c}
£ \quad s. \qquad £ \quad s. \quad d. \qquad £ \qquad\qquad £ \\
124 \quad 15 \; : \; 421 \quad 0 \quad 7\frac{1}{2} \; :: \; 100 \; : \; £337 \; 10s.
\end{array}
$$

(10)... $\qquad\qquad$
$$
\begin{array}{r}
1463818 \\
(753)^2 = \quad 567009 \\
\hline
896809(947 \\
81 \\
\hline
184) \overline{\;868} \\
736 \\
\hline
1887)\overline{13209} \\
13209 \\
\hline
\end{array}
$$

EXERCISE LXXXVIII.

(1)...

```
493)1073(2              29)1537(53
     986                    145
     ¯87)493(5               87
        435                  87
        ¯58)87(1
           58         G.C.M. required = 29
           29)58(2
              58
```

G.C.M. of 493 and 1073 = 29

```
2)5   7   9  12  15  18  21  27
3)5   7   9   6  15   9  21  27
3)5   7   3   2   5   3   7   9
5)5   7   1   2   5   1   7   3
7)1   7   1   2   1   1   7   3·
  1   1   1   2   1   1   1   3
```

L.C.M. $= 2 \times 3 \times 3 \times 5 \times 7 \times 2 \times 3 = 3780$

(2)...

$$1\tfrac{5}{6} \times 2\tfrac{2}{9} \times 5\tfrac{1}{4} \times \tfrac{6}{11} \times 3\tfrac{3}{5} \times 2\tfrac{2}{7}$$

$$= \frac{\cancel{11}}{\cancel{6}} \times \frac{\overset{4}{\cancel{20}}}{\cancel{9}} \times \frac{\overset{3}{\cancel{21}}}{\cancel{4}} \times \frac{\cancel{6}}{\cancel{11}} \times \frac{\overset{2}{\cancel{18}}}{\cancel{5}} \times \frac{16}{7} = 96$$

$$\frac{6\tfrac{3}{4} \times 3\tfrac{5}{9}}{7\tfrac{1}{2} + \tfrac{5}{6}} = \frac{\dfrac{\overset{3}{\cancel{27}}}{\cancel{4}} \times \dfrac{\overset{8}{\cancel{32}}}{\cancel{9}}}{\dfrac{\cancel{15}}{\cancel{2}} \times \dfrac{\cancel{8}}{\cancel{5}}} = \frac{24}{12} = 2$$

o

(3)...

$$
\begin{array}{r}
7{\cdot}0046 \\
{\cdot}215 \\
\hline
350230 \\
70046 \\
140092 \\
\hline
1{\cdot}5059890
\end{array}
$$

$$
{\cdot}0565)8{\cdot}2500000(146{\cdot}017\ldots\ldots
$$

$$
\begin{array}{r}
565 \\
\hline
2600 \\
2260 \\
\hline
3400 \\
3390 \\
\hline
1000 \\
565 \\
\hline
4350 \\
3955 \\
\hline
395
\end{array}
$$

(4)...

$$
\frac{23}{36}\ \text{gui.} = \frac{23}{\cancel{36}_{12}}\times\frac{\overset{7}{\cancel{21}}}{1} = \frac{161}{12} = 13\ \overset{s.}{}\ 5\ \overset{d.}{}
$$

$$
\tfrac{19}{24}\ \text{cr.} = \tfrac{19}{24}\times\tfrac{5}{1} = \tfrac{95}{24} = \quad 3\ \ 11\tfrac{1}{2}
$$

sov.
$$
\begin{array}{l}
{\cdot}48125 = 9s.\ 7\tfrac{1}{2}d. \\
\quad\ 20 \\
\hline
9{\cdot}62500s. \\
\quad\ 12 \\
\hline
7{\cdot}50000d. \\
\quad\ \ 4 \\
\hline
2{\cdot}00000\ \text{far.}
\end{array}
$$

fl.
$$
\begin{array}{l}
{\cdot}65625 = 1s.\ 3\tfrac{3}{4}d. \\
\quad\ \ 2 \\
\hline
1{\cdot}31250s. \\
\quad\ 12 \\
\hline
3{\cdot}75000d. \\
\quad\ \ 4 \\
\hline
3{\cdot}00000\ \text{far.}
\end{array}
$$

$$
\begin{array}{lrl}
 & s. & d. \\
\tfrac{23}{36}\ \text{of a guinea} = & 13 & 5 \\
{\cdot}48125\ \text{of a sov.} = & 9 & 7\tfrac{1}{2} \\
\tfrac{19}{24}\ \text{of a crown} = & 3 & 11\tfrac{1}{2} \\
{\cdot}65625\ \text{of a florin} = & 1 & 3\tfrac{3}{4} \\
\hline
\pounds 1\quad\ 8 & & 3\tfrac{3}{4}
\end{array}
$$

(5)...

$$
\begin{array}{lll}
 & s. & d. \\
1. & 5 & 0 = \tfrac{1}{4}\ \text{of}\ \pounds 1 \\
 & 1 & 3 = \tfrac{1}{4}\ \text{of}\ 5s. \\
 & & 3\tfrac{3}{4} = \tfrac{1}{4}\ \text{of}\ 1s.\ 3d. \\
 & & 1 = \tfrac{1}{15}\ \text{of}\ 1s.\ 3d.
\end{array}
$$

$$
\begin{array}{rrl}
\pounds & s. & d. \\
1527 & 0 & 0 = \text{value at}\ \pounds 1\ \text{ea} \\
\hline
381 & 15 & 0 \\
95 & 8 & 9 \\
23 & 17 & 2\tfrac{1}{4} \\
6 & 7 & 3 \\
\hline
\pounds 507 & 8 & 2\tfrac{1}{4}
\end{array}
$$

$$
\begin{array}{llll}
 & s. & d. & \\
2. & 10 & 0 & = \tfrac{1}{2} \text{ of } \pounds 1 \\
 & 5 & 0 & = \tfrac{1}{2} \text{ of } 10s. \\
 & 2 & 6 & = \tfrac{1}{2} \text{ of } 5s. \\
 & & 2\tfrac{1}{2} & = \tfrac{1}{12} \text{ of } 2s.\ 6d.
\end{array}
\qquad
\begin{array}{rrr}
\pounds & s. & d. \\
2439 & 0 & 0 = \text{value at } \pounds 1 \text{ each} \\
\hline
1219 & 10 & 0 \\
609 & 15 & 0 \\
304 & 17 & 6 \\
25 & 8 & 1\tfrac{1}{2} \\
\hline
\pounds 2159 & 10 & 7\tfrac{1}{2}
\end{array}
$$

$$
\begin{array}{llll}
 & s. & d. & \\
3. & 10 & 0 & = \tfrac{1}{2} \text{ of } \pounds 1 \\
\\
\\
 & 2 & 6 & = \tfrac{1}{4} \text{ of } 10s. \\
 & 1 & 3 & = \tfrac{1}{2} \text{ of } 2s.\ 6d. \\
 & & 5 & = \tfrac{1}{3} \text{ of } 1s.\ 3d. \\
 & & \tfrac{1}{2} & = \tfrac{1}{10} \text{ of } 5d.
\end{array}
\qquad
\begin{array}{rrr}
\pounds & s. & d. \\
967 & 0 & 0 = \text{value at } \pounds 1 \text{ each} \\
 & & 5 \\
\hline
4835 & 0 & 0 \\
483 & 10 & 0 \\
120 & 17 & 6 \\
60 & 8 & 9 \\
20 & 2 & 11 \\
2 & 0 & 3\tfrac{1}{2} \\
\hline
\pounds 5521 & 19 & 5\tfrac{1}{4}
\end{array}
$$

$$
(6)\ldots
\begin{array}{ccccccc}
\text{hor. da.} & & \text{hor. da.} & & \text{bu.} & & \text{bu.} \\
9 \times 20 & : & 17 \times x & :: & 45 & : & 68
\end{array}
$$

$$
x = \frac{9 \times \cancel{20}^{4} \times \cancel{68}^{4}}{\cancel{17} \times \cancel{45}_{5}} = 16 \text{ days}
$$

$$
(7)\ldots
\begin{array}{ccccccccc}
\text{m. da. hrs.} & & \text{m. da. hrs.} & & \pounds & s. & d. & & \\
9 \times 13 \times 9 & : & 13 \times 17 \times 11 & :: & 26 & 6 & 6 & : & x
\end{array}
$$

$$
\begin{array}{r}
20 \\
\hline
526 \\
12 \\
\hline
6318
\end{array}
$$

$$
x = \frac{\cancel{13} \times 17 \times 11 \times \cancel{6318}^{\,702\ (78)}}{\cancel{9} \times \cancel{13} \times \cancel{9}} = 14586d. = \pounds 60\ 15s.\ 6d.
$$

(8)...   4 per cent. $= \frac{1}{25}$ of 100

$$
\begin{array}{rrr}
& \pounds & s. & d. \\
& 262 & 10 & 0 = 250 \text{ guineas} \\
\end{array}
$$

$\frac{1}{2}$ „ $= \frac{1}{8}$ of 4

$$
\begin{array}{rrr}
10 & 10 & 0 \\
1 & 6 & 3 \\
\hline
\pounds 11 \quad 16 & \quad 3 & \text{int. for 1 year} \\
& 3\frac{1}{2} \\
\hline
35 \quad 8 & 9 \\
5 \quad 18 & 1\frac{1}{2} \\
\hline
\pounds 41 \quad 6 & 10\frac{1}{2} & \text{int. for } 3\frac{1}{2} \text{ years} \\
\end{array}
$$

(9)... $1\frac{1}{4}$ per cent. $= \frac{1}{80}$ of 100)

$$
\begin{array}{rrr}
\pounds & s. & d. \\
475 & 0 & 0 \\
\hline
\pounds 5 & 18 & 9 \\
\end{array}
$$

(10)...

$$
\begin{array}{l}
\cdot 11737476(\cdot 3426 \\
\quad 9 \\
\overline{64)\ 273} \\
\quad 256 \\
\overline{682)\ 1774} \\
\quad 1364 \\
\overline{6846)\ 41076} \\
\quad 41076 \\
\end{array}
$$

$$
\begin{array}{l}
\cdot 00025281(\cdot 0159 \\
\quad 1 \\
\overline{25)152} \\
\quad 125 \\
\overline{309)\ 2781} \\
\quad 2781 \\
\end{array}
$$

EXERCISE LXXXIX.

(1)...

			s.	d.	£	s.	d.
$13\frac{3}{4}$ yds.	Silk Velvet......	7	6	= 5	3	$1\frac{1}{2}$	
$7\frac{1}{2}$ „	Crape	2	9	= 1	0	$7\frac{1}{2}$	
$3\frac{5}{8}$ „	Cloth	10	8	= 1	18	8	
$26\frac{1}{2}$ „	Irish Linen......	1	10	= 2	8	7	
18 „	Flannel	1	4	= 1	4	0	

$$
\begin{array}{rrr}
& 11 & 15 & 0 \\
\end{array}
$$

Discount, $2\frac{1}{2}$ per cent. $= \frac{1}{40}$ of 100 $=$

$$
\begin{array}{rrr}
5 & 10\frac{1}{2} \\
\hline
\pounds 11 \quad 9 & 1\frac{1}{2} \\
\end{array}
$$

$$
\begin{array}{cccccccc}
 & \text{lb.} & \text{oz.} & & \text{lb.} & \text{oz.} & & \pounds & s. & d. \\
(2)\ldots & 7 & 11 & : & 77 & 7 & :: & 1 & 8 & 2\tfrac{1}{4} & : & x \\
 & 16 & & & 16 & & & 20 \\
\cline{2-2}\cline{5-5}\cline{8-8}
 & \overline{123} & & & \overline{1239} & & & \overline{28} \\
 & & & & & & & 12 \\
 & & & & & & & \overline{338} \\
 & & & & & & & 4 \\
 & & & & & & & \overline{1353}
\end{array}
$$

$$
x = \frac{1239 \times \overset{11}{\cancel{1353}}}{\cancel{123}} = 13629 \text{ far.} = \pounds 14 \ 3s. \ 11\tfrac{1}{4}d.
$$

$$
(3)\ldots \quad (1\tfrac{5}{7})^2 \times (3\tfrac{1}{2})^3 = \frac{\overset{3}{\cancel{\underset{6}{12}}}}{7} \times \frac{\overset{6}{\cancel{12}}}{7} \times \frac{7}{\cancel{2}} \times \frac{7}{\cancel{2}} \times \frac{7}{\cancel{2}} = 126
$$

$$
(4)\ldots \quad \frac{25}{42} \text{ gui.} = \frac{25}{\underset{2}{\cancel{42}}} \times \frac{\overset{s.}{\cancel{21}}}{1} = \frac{25}{2} = \overset{s.}{12} \ \overset{d.}{6}
$$

$$
\frac{37}{64} \text{ sov.} = \frac{37}{\cancel{64}} \times \frac{\overset{5}{\cancel{20}}}{1} = \frac{185}{16} = 11 \ 6\tfrac{3}{4}
$$

$$
\underset{16 \quad \text{difference} = \overline{\quad 11\tfrac{1}{4}}}{}
$$

$$
(5)\ldots \quad \overset{\text{week}}{\cdot 3125} = 2 \text{ days } 4 \text{ hrs. } 30 \text{ min.}
$$

$$
\begin{array}{l}
7 \\
\hline
2\cdot 1875 \text{ da.} \\
24 \\
\hline
4\cdot 5000 \text{ hrs.} \\
60 \\
\hline
30\cdot 0000 \text{ min.}
\end{array}
$$

$$
\frac{37}{96} \text{ da.} = \frac{37}{\underset{4}{\cancel{96}}} \times \frac{\overset{\text{hrs.}}{\cancel{24}}}{1} = \frac{37}{4} = 9 \text{ hrs. } 15 \text{ min.}
$$

$$
\begin{array}{ccc}
\text{da.} & \text{hrs.} & \text{min.} \\
2 & 4 & 30 \\
 & 9 & 15 \\
\hline
\text{day } 1 & 19 & 15 \text{ min.}
\end{array}
$$

(6)...

$$\begin{array}{ccccc} & & \pounds & s. & d. \\ \tfrac{5}{11} \text{ of } \pounds 4 \ 4s. \ 4d. &=& 1 & 18 & 4 \\ \tfrac{3}{8} \text{ of } \pounds 4 \ 4s. \ 4d. &=& 1 & 11 & 7\tfrac{1}{2} \\ \hline & \pounds 3 & 9 & 11\tfrac{1}{2} \end{array}$$

$$\begin{array}{ccccc} & & \pounds & s. & d. \\ & & 4 & 4 & 4 \\ \text{sum spent} &=& 3 & 9 & 11\tfrac{1}{2} \\ \hline \text{sum remaining} &=& & 14s. & 4\tfrac{1}{2}d. \end{array}$$

(7)...

$$\begin{array}{ccccccc} \text{hrs.} & & \text{hrs.} & & \text{mi.} & & \\ 8\tfrac{1}{2} & : & 7\tfrac{1}{12} & :: & 7\tfrac{3}{4} & : & x \end{array}$$

$$x = \frac{2}{\cancel{17}} \times \frac{\cancel{85}^5}{\cancel{12}_6} \times \frac{31}{4} = \frac{155}{24} \text{ mi.} = 6\tfrac{11}{24} \text{ miles per hour}$$

(8)...

$$\begin{aligned} \text{If A's share} &= 1 \\ \text{B's share} &= \tfrac{4}{5} \\ \text{and C's share} &= \tfrac{5}{7} \text{ of } \tfrac{4}{5} = \tfrac{4}{7} \end{aligned}$$

$$1 + \frac{4}{5} + \frac{4}{7} = \frac{35 + 28 + 20}{35} = \frac{83}{35}$$

$$\begin{array}{ccccccc} \tfrac{83}{35} & : & 1 & :: & \pounds 145 \ 5s. = \pounds 145\tfrac{1}{4} & : & x \end{array}$$

$$x = \frac{35}{\cancel{83}} \times \frac{\cancel{581}^7}{4} = \pounds\frac{245}{4} = \pounds 61 \ 5s. \quad \text{A's share}$$

$$\begin{array}{lll} \tfrac{4}{5} \text{ of } \pounds 61 \ 5s. = \pounds 49 \ 0s. & \text{B's share} \\ \tfrac{5}{7} \text{ of } \pounds 49 \ 0s. = \underline{\pounds 35 \ 0s.} & \text{C's share} \\ \pounds 145 \ 5s. \end{array}$$

(9)...

$$\begin{array}{ccccccc} & & & & \pounds & s. & \\ 4\tfrac{1}{2} & : & 100 & :: & 169 & 13 & : \quad \text{cost of farm} \\ \tfrac{2}{9} & & \overline{200}^{\,2} & & \overline{3393}^{\,20} & & \end{array}$$

$$\text{cost of farm} = \frac{200 \times \cancel{3393}^{377}}{\cancel{9}} = 75400s. = \pounds 3770$$

(10)...
$$2989683684(54678$$
$$25$$
$$104)\overline{\ 489}$$
$$416$$
$$1086)\overline{\ 7368}$$
$$6516$$
$$10927)\overline{\ 85236}$$
$$76489$$
$$109348)\overline{\ 874784}$$
$$874784$$

$$38950081(6241$$
$$36$$
$$122)\overline{\ 295}$$
$$244$$
$$1244)\overline{\ 5100}$$
$$4976$$
$$12481)\overline{\ 12481}$$
$$12481$$

$$6241(79$$
$$49$$
$$149)\overline{1341}$$
$$1341$$

EXERCISE XC.

	cwt.	qrs.	lb.		cwt.	qr.	lb.		£	s.	d.		
(1)...	2	2	14	:	3	1	21	::	18	1	$4\frac{1}{2}$	:	x
	4				4				20				
	$\overline{10}$				$\overline{13}$				$\overline{361}$				
	28				28				12				
	$\overline{294}$				$\overline{385}$				$\overline{4336}$				
									4				
									$\overline{17346}$				

$$x = \frac{\cancel{385}^{55} \times \cancel{17346}^{413}}{\cancel{294}_{\cancel{42}^{}}} = 22715 \text{ far.} = £23 \ 13s. \ 2\frac{3}{4}d.$$

(2)...

$$\begin{array}{cc} \pounds & s. \\ 271 & 5 \\ & 7 \end{array}$$

$$17\tfrac{5}{7} \times 7 = 124)\overline{1898\ 15}(\pounds15\ 6s.\ 3d.$$

$$\begin{array}{l} \underline{124} \\ \overline{658} \\ 620 \\ \overline{38} \\ 20 \\ 124)\overline{775}(6s. \\ 744 \\ \overline{31} \\ 12 \\ 124)\overline{372}(3d. \\ 372 \\ \overline{} \end{array}$$

(3)...

$$\begin{array}{llll} & \pounds & s. & d. \\ \pounds1\tfrac{13}{24} = & 1 & 10 & 10 \\ 13\tfrac{5}{6}s. = & 0 & 13 & 10 \\ 7\tfrac{3}{4}d. = & 0 & 0 & 7\tfrac{3}{4} \\ \hline \pounds2 & 5 & 3\tfrac{3}{4} \end{array}$$

$$\begin{array}{l} 4)3 \\ \overline{12)3\cdot75} \\ \overline{20)5\cdot3125} \\ \overline{5)2\cdot265625} \\ \overline{\cdot453125} \text{ of } \pounds5 \end{array}$$

(4)...

$$\begin{array}{r} 23\cdot5 \\ 17\cdot6 \\ \hline 1410 \\ 1645 \\ 235 \\ \hline 413\cdot60 \\ 9\cdot25 \\ \hline 206800 \\ 82720 \\ 372240 \\ \hline 3825\cdot8000 \end{array}$$

(5)...

$$(\cdot17)^2 = \cdot0289$$
$$(\cdot5)^3 = \cdot125$$

$$\begin{array}{r} \hline 1445 \\ 578 \\ 289 \\ \hline \cdot0036125 \end{array}$$

(6)...

$$178\cdot35)45657\cdot60(256$$
$$\begin{array}{r} 35670 \\ \hline 99876 \\ 89175 \\ \hline 107010 \\ 107010 \\ \hline \end{array}$$

$$67\cdot8)71\cdot90190(1\cdot0605$$
$$\begin{array}{r} 678 \\ \hline 4101 \\ 4068 \\ \hline 3390 \\ 3390 \\ \hline \end{array}$$

(7)...

$$
\begin{array}{rrr}
£ & s. & d. \\
724 & 3 & 4 \quad \text{amount} \\
617 & 3 & 9 \quad \text{principal} \\
\hline
£106 & 19 & 7 \quad \text{interest}
\end{array}
$$

$$
\begin{array}{l}
\text{4 per cent.} = \frac{1}{25} \text{ of } 100 \\
\text{¼ per cent.} = \frac{1}{12} \text{ of } 4
\end{array}
\left|
\begin{array}{rrr}
£. & s. & d. \\
617 & 3 & 9 \\
\hline
24 & 13 & 9 \\
2 & 1 & 1\frac{3}{4} \\
\hline
£26 & 14 & 10\frac{3}{4} \quad \text{interest for 1 year}
\end{array}
\right.
$$

$$
\begin{array}{ccccccccc}
£ & s. & d. & & £ & s. & d. & & \text{yr.} & & \text{yrs.} \\
26 & 14 & 10\frac{3}{4} & : & 106 & 19 & 7 & :: & 1 & : & 4
\end{array}
$$

(8)...

$$
\begin{array}{r}
\text{112 lb. at } 3\frac{1}{2}d. \text{ per oz.} = \begin{array}{rrr} £ & s. & d. \\ 26 & 2 & 8 \end{array} \\
\text{cost} = 18 \quad 13 \quad 4 \\
\hline
\text{profit} = £7 \quad 9 \quad 4
\end{array}
$$

$$
\begin{array}{ccccccccc}
£ & s. & d. & & £ & s. & d. & & & & \\
18 & 13 & 4 & : & 7 & 9 & 4 & :: & 100 & : & \text{40 per cent.}
\end{array}
$$

(9)...

$$
\begin{array}{r}
20226\overset{\centerdot}{2}00\overset{\centerdot}{3}(587 \\
5^3 = 125 \\
5^2 \times 300 = 7500)\overline{77262} \\
\hline
60000 = 7500 \times 8 \\
9600 = 5 \times 30 \times 8^2 \\
512 = 8^3 \\
\hline
70112 \text{ subtrahend} \\
58^2 \times 300 = 1009200)\overline{7150003} \\
\hline
7064400 = 1009200 \times 7 \\
85260 = 58 \times 30 \times 7^2 \\
343 = 7^3 \\
\hline
7150003
\end{array}
$$

(10)... $(\frac{1}{3}+£25)+(\frac{1}{4}+£122 \ 10s.)+(\frac{1}{5}+£145)$

$\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+£292 \ 10s.$

$$\frac{1}{3}+\frac{1}{4}+\frac{1}{5} = \frac{20+15+12}{60} = \frac{47}{60}$$

$1-\frac{47}{60} = \frac{13}{60}$, which is $= £292 \ 10s.$

$$\overset{£ \quad\quad s. \quad\quad\quad £}{\frac{13}{60} \ : \ 1 \ :: \ 292 \ 10 = 292\tfrac{1}{2} \ : \ \text{sum divided}}$$

$$\text{sum divided} = \frac{\overset{30}{\cancel{60}}}{\cancel{13}} \times \frac{\overset{45}{\cancel{585}}}{\cancel{2}} = £1350$$

$(\frac{1}{3}$ of £1350$)+£25$ $= £475$, A's share

$(\frac{1}{4}$ of £1350$)+£122 \ 10s. = £460$, B's share

$(\frac{1}{5}$ of £1350$)+£145$ $= £415$, C's share

EXERCISE XCI.

(1)...   See "*Answers.*"

(2)... $25\begin{cases} 5)17 \\ \overline{5)3\cdot 4} \\ \overline{\quad\cdot 68} \end{cases}$ $32\begin{cases} 4)23 \\ \overline{8)5\cdot 75} \\ \overline{\quad\cdot 71875} \end{cases}$

    $\dfrac{12)7}{\quad\cdot 5833 \ \&c. = \cdot 583}$ $18\begin{cases} 2)11 \\ \overline{9)5\cdot 5} \\ \overline{\quad\cdot 611 \ \&c. = \cdot 61} \end{cases}$

(3)...

	£	s.	d.	
	5	6	8	per ton
			$4\times 7+1 = 29$	
	21	6	8	
			7	
	149	6	8	
10 cwt. $= \frac{1}{2}$ of 1 ton	5	6	8	
2½ cwt. $= \frac{1}{4}$ of 10 cwt.	2	13	4	
1¼ cwt. $= \frac{1}{2}$ of 2½ cwt.		13	4	
14 lb. $= \frac{1}{10}$ of 1¼ cwt.		6	8	
7 lb. $= \frac{1}{2}$ of 14 lb.			8	
			4	
	£158	7	8	

(4)...
$$9\tfrac{33}{80} \text{ tons} = 188\tfrac{1}{4} \text{ cwt.}$$

$$\underset{\text{cwt.}}{13\tfrac{9}{14}} \quad : \quad \underset{\text{cwt.}}{188\tfrac{1}{4}} \quad :: \quad \underset{\pounds}{14\tfrac{13}{40}} \quad : \quad x$$

$$x = \frac{\overset{7}{\cancel{14}}}{\cancel{191}} \times \frac{753}{\underset{2}{\cancel{4}}} \times \frac{\overset{3}{\cancel{573}}}{40} = \pounds\frac{15813}{80} = \pounds 197\ 13s.\ 3d.$$

(5)...
$$\tfrac{11}{14} : \tfrac{17}{21} = \tfrac{33}{42} : \tfrac{34}{42}$$

hence 17 : 21 is the greater ratio

(6)...
$$\tfrac{5}{7} : \tfrac{7}{9} = \frac{\tfrac{5}{7}}{\tfrac{7}{9}} = \frac{5 \times 9}{7 \times 7} = \frac{45}{49}$$

(7)... Sum paid per month to men

$$= \pounds 1\ 5s. \times 4 \times 64 = \pounds 320$$

$$\therefore \pounds 360 - \pounds 320 = \pounds 40 = \text{sum paid monthly to boys}$$

monthly wages of each boy $= 8s. \times 4 = 32s.$

$\therefore$ the number of boys $= \pounds 40 \div 32s. = 800 \div 32 = 25$

(8)...
$$\begin{array}{cccc}
\underset{\text{t. cwt. mi.}}{2\ \ 15 \times 36} & : & \underset{\text{cwt.}\qquad\text{mi.}}{2\tfrac{1}{2} \times 18 \times 85} & : & \underset{\pounds\ \ s.\ \ d.}{4\ \ 2\ \ 6} & : & x \\
\ \ 20 & & \ \ 2 & & \ \ 20 \\
\overline{\ \ 55} & & \overline{\ \ 5} & & \overline{\ \ 82} \\
\ \ \ 2 & & & & \ \ 12 \\
\overline{110} & & & & \overline{990}
\end{array}$$

$$x = \frac{5 \times \cancel{18} \times 85 \times \overset{9}{\cancel{990}}}{\cancel{110} \times \underset{2}{\cancel{36}}} = \frac{3825}{2}d. = \pounds 7\ 19s.\ 4\tfrac{1}{2}d.$$

(9)...
$$
\begin{array}{r}
1378235925\dot{1}\dot{6}(371246 \\
9 \\
\hline
67)\ \overline{478} \\
469 \\
\hline
741)\ \overline{923} \\
741 \\
\hline
7422)\overline{18259} \\
14844 \\
\hline
74244)\ \overline{341525} \\
296976 \\
\hline
742486)\ \overline{4454916} \\
4454916 \\
\end{array}
$$

$$\sqrt{472\tfrac{9}{121}} = \sqrt{\tfrac{57121}{121}} = \tfrac{239}{11} = 21\tfrac{8}{9}$$

(10)...
$$
\begin{array}{r}
444194947(763 \\
7^3 = 343 \\
\end{array}
$$

$7^2 \times 300 = 14700)\overline{101194}$

$$
\begin{array}{rl}
88200 &= 14700 \times 6 \\
7560 &= 7 \times 30 \times 6^2 \\
216 &= 6^3 \\
\hline
95976 & \text{subtrahend}
\end{array}
$$

$76^2 \times 300 = 1732800)\ \overline{5218947}$

$$
\begin{array}{rl}
5198400 &= 1732800 \times 3 \\
20520 &= 76 \times 30 \times 3^2 \\
27 &= 3^3 \\
\hline
5218947 &
\end{array}
$$

EXERCISE XCII.

(1)...
$$
\begin{array}{ccc}
s. & d. & d. \\
3 & 9 & = 45 \\
& & 60\tfrac{1}{2} \\
\hline
& & 2700 \\
& & 22\tfrac{1}{2} \\
\hline
\end{array}
$$

$8s.\ 3d. = 99d. \left\{ \begin{array}{l} 9)\overline{2722\tfrac{1}{2}} \\ 11)\overline{302\tfrac{1}{2}} \end{array} \right.$

$\overline{27\tfrac{1}{2}}$ yds. of velvet

(2)...

$$\left(\tfrac{5}{8} \text{ of } \frac{5\frac{1}{3}}{7\frac{1}{2}}\right) \times (\tfrac{1}{9} \text{ of } 4\tfrac{1}{8})$$

$$= \frac{\cancel{5}}{\cancel{8}} \times \frac{\overset{4}{\cancel{32}}}{\underset{9}{\cancel{45}}} \times \frac{1}{\underset{3}{\cancel{9}}} \times \frac{\overset{11}{\cancel{33}}}{\underset{2}{\cancel{8}}} = \frac{11}{54};$$

$$17\tfrac{1}{4} \div 6\tfrac{3}{4} = \frac{\overset{23}{\cancel{69}}}{\cancel{4}} \times \frac{\cancel{4}}{\underset{9}{\cancel{27}}} = \frac{23}{9} = 2\tfrac{5}{9}$$

(3)...

$$\frac{13}{16} \text{ flo.} = \frac{13}{\underset{8}{\cancel{16}}} \times \frac{\cancel{2}}{1} = \frac{13}{8} = \overset{s.}{1} \quad \overset{d.}{7\tfrac{1}{2}}$$

$$\cancel{1\tfrac{1}{8}} \text{ hf. cr.} = \tfrac{11}{8} \times \tfrac{5}{2} = \tfrac{55}{36} = 1 \quad 6\tfrac{1}{3}$$
$$\text{difference} = \overline{\qquad 1\tfrac{1}{6}}$$

(4)...

```
    29·5625
    25·725
  ─────────
   1478125
    591250
  2069375
  1478125
   591250
  ─────────
760·4953125 ·
```

$$29\cdot5625 = 29\tfrac{5625}{10000} = 29\tfrac{9}{16}$$

$$25\cdot725 = 25\tfrac{725}{1000} = 25\tfrac{29}{40}$$

$$29\tfrac{9}{16} \times 25\tfrac{29}{40} = \tfrac{473}{16} \times \tfrac{1029}{40} = \tfrac{486717}{640} = 760\tfrac{317}{640}$$

$$640 \begin{cases} 10)317 \\ \overline{8)31\cdot7} \\ \overline{8)3\cdot9625} \\ \overline{\quad \cdot4953125} \end{cases}$$

$$\therefore 760\tfrac{317}{640} = 760\cdot4953125$$

(5)... $69 \cdot 15)486 \cdot 829830(7 \cdot 0402$
  48405
  ――――
  27798
  27660
  ――――
  13830
  13830
  ――――

$\cdot 6915)486 \cdot 829830(704 \cdot 02$
  48405
  ――――
  27798
  27660
  ――――
  13830
  13830
  ――――

	s.	d.		£	s.	d.	
(6)...1.	3	4	$=\frac{1}{6}$ of £1	1979	0	0	=value at £1 per yd.
		4	$=\frac{1}{10}$ of 3s. 4d.	329	16	8	
		$\frac{1}{2}$	$=\frac{1}{8}$ of 4d.	32	19	8	
				4	2	$5\frac{1}{2}$	
				£366	18	$9\frac{1}{2}$	

		£	s.	d.	
2.	2 qrs. $= \frac{1}{2}$ of 1 cwt.	2	10	0	per cwt.
				11	
		27	10	0	
	7 lb. $= \frac{1}{8}$ of 2 qrs.	1	5	0	
			3	$1\frac{1}{2}$	
		£28	18	$1\frac{1}{2}$	

		£	s.	d.	
3.	4 bu. $= \frac{1}{2}$ of 1 qr.	3	7	6	per quarter
				9	
		30	7	6	
	1 bu. $= \frac{1}{4}$ of 4 bu.	1	13	9	
	2 pks. $= \frac{1}{2}$ of 1 bu.		8	$5\frac{1}{4}$	
	1 pk. $= \frac{1}{2}$ of 2 pks.		4	$2\frac{5}{8}$	
			2	$1\frac{5}{16}$	
		£32	16	$0\frac{3}{16}$	

$$
\begin{array}{lcccl}
\textbf{4.} & 2 \text{ ro.} = \tfrac{1}{2} \text{ of 1 ac.} & & \pounds \quad s. \quad d. & \\
& & & 2 \quad 8 \quad 0 & \text{ per acre} \\
& & & \multicolumn{1}{c}{11 \times 11 \times 3 = 363} \\
\end{array}
$$

	£	s.	d.
	2	8	0 per acre
	26	8	0
		11	
	290	8	0
		3	
	871	4	0
1 ro. = ½ of 2 ro.	1	4	0
10 per. = ¼ of 1 ro.		12	0
5 per. = ½ of 10 per.		3	0
		1	6
	£873	4	6

$11 \times 11 \times 3 = 363$

$$
\begin{array}{l}
\pounds \quad\quad s. \quad\quad d. \\
\end{array}
$$

(7)...4 per cent. $= \tfrac{1}{25}$ of 100)347 16 3

	£	s.	d.	
	13	18	3	int. for 1 year
		$2\tfrac{1}{4}$		
	27	16	6	
	3	9	$6\tfrac{3}{4}$	
	£31	6	$0\tfrac{3}{4}$	int. for 2¼ years

(8)...
$$
\begin{array}{ccccccl}
\pounds & & \pounds & & \pounds & & \\
73\tfrac{1}{2} & : & 5000 & :: & 3\tfrac{1}{2} & : & \text{income required} \\
2 & & & & 2 & & \\
\hline
147 & & & & 7 & &
\end{array}
$$

$$
\text{income required} = \frac{5000 \times \overset{}{7}}{\underset{21}{\cancel{147}}} = \pounds \frac{5000}{21} = \pounds 238 \; 1s. \; 10\tfrac{6}{7}d.
$$

(9)...
$$
\begin{array}{cc}
100 \cdot & 100 \\
14 & 10 \\
\hline
86 & 110
\end{array}
$$

$$
\begin{array}{ccccccccl}
& & & & \pounds & s. & d. & & \\
86 & : & 110 & :: & 24 & 14 & 6 & : & x \\
& & & & & 20 & & & \\
\hline
& & & & & 494 & & & \\
& & & & & 12 & & & \\
\hline
& & & & & 5934 & & &
\end{array}
$$

$$
x = \frac{110 \times \overset{69}{\cancel{5934}}}{\underset{}{\cancel{86}}} = 7590d. = \pounds 31 \; 12s. \; 6d.
$$

(10)... $\sqrt{136\frac{120}{169}} = \sqrt{\frac{23104}{169}} = \frac{152}{13} = 11\frac{9}{13}$;

$\sqrt[3]{198\frac{197}{216}} = \sqrt[3]{\frac{42875}{216}} = \frac{35}{6} = 5\frac{5}{6}$;

$\sqrt[4]{447\frac{466}{625}} = \sqrt[4]{\frac{279841}{625}} = \frac{23}{5} = 4\frac{3}{5}$

EXERCISE XCIII.

	£	s.	d.
(1)...	1	17	9

$9 \times 9 \times 9 = 729$

	£	s.	d.
	16	19	9
			9
	152	17	9
			9
	£1375	19	9

(2)... Loss in the pound $= 20s. - 12s.\ 10\frac{1}{2}d. = 7s.\ 1\frac{1}{2}d.$

	£	s.	d.
$5s. = \frac{1}{4}$ of £1	2456	16	8
$2s. = \frac{1}{10}$ of £1	614	4	2
$1\frac{1}{2}d. = \frac{1}{16}$ of $2s.$	245	13	8
	15	7	$1\frac{1}{4}$
	£675	4	$11\frac{1}{4}$

(3)...

yds.		yds.			£	s.	d.		
$49\frac{3}{4}$	:	$51\frac{1}{2} \times 13$	::		1	0 ,	$8\frac{3}{4}$	:	x
4		4			20				
199		206			20				
					12				
					248				
					4				
					995				

$$x = \frac{206 \times 13 \times \overset{5}{\cancel{995}}}{\cancel{199}} = 13390 \text{ far.} = £13\ 18s.\ 11\frac{1}{2}d.$$

(4)...

$$\begin{array}{ccc} £ & s. & d. \\ 231 & 7 & 1\frac{1}{4} \\ & & 18 \end{array}$$

$$18\tfrac{7}{18} \times 18 = 331)\overline{4164\ \ 7\ \ 10\tfrac{1}{2}}(£12\ 11s.\ 7\tfrac{1}{2}d.$$

$$\begin{array}{l} 3972 \\ \overline{\ \ 192} \\ \ \ \ 20 \\ 331)\overline{3847}(11s. \\ \ \ 3641 \\ \overline{\ \ \ 206} \\ \ \ \ \ 12 \\ 331)\overline{2482}(7d. \\ \ \ 2317 \\ \overline{\ \ \ 165} \\ \ \ \ \ \ 4 \\ 331)\overline{662}(2f. \\ \ \ \ 662 \\ \ \ \ \overline{} \end{array}$$

(5)...   1 qr. = $\frac{1}{4}$ of 1 cwt.

$$\begin{array}{ccc} £ & s. & d. \\ 3 & 19 & 4 \text{ per cwt.} \\ & & 10 \\ \hline 39 & 13 & 4 \\ & 19 & 10 \\ & 1 & 5 \\ \hline \end{array}$$

2 lb. = $\frac{1}{14}$ of 1 qr.

£40 14   7 value of Cheshire cheese

$12\frac{1}{2}$ lb. Stilton cheese at $11\frac{1}{2}d.$ = $11s.\ 11\frac{3}{4}d.$

£40 14s. 7d. ÷ 11s. $11\frac{3}{4}d.$ = 68, No. of Stilton cheeses

(6)...

$$\begin{array}{ccccccc} \text{ho.} & \text{min.} & & \text{ho.} & & \text{min.} & \\ 7 & 28 & : & 1 & :: & 28 & : & x \\ & 60 & & 60 & & \\ \hline & 448 & & 60 & & \end{array}$$

$$x = \frac{\overset{15}{\cancel{60}} \times \cancel{28}}{\underset{\underset{4}{\cancel{16}}}{\cancel{448}}} = \frac{15}{4} \text{ mi.} = 3\tfrac{3}{4} \text{ miles per hour}$$

P

(7)... $\frac{7}{9}$ of $\frac{8}{11} = \frac{56}{99}$ = elder son's portion

$1 - \frac{56}{99} = \frac{43}{99}$ = younger son's portion

Difference, $\frac{56}{99} - \frac{43}{99} = \frac{13}{99}$, which is $= £466$ $1s.$

$$\frac{13}{99} \;:\; 1 \;::\; \overset{£\quad\; s.}{466 \quad 1} \;:\; \text{value of estate}$$

$$\frac{20}{9321}$$

Value of estate $= \dfrac{99}{\cancel{13}} \times \dfrac{\overset{717}{\cancel{9321}}}{1} = 70983s. = £3549 \; 3s.$

Elder son's portion $= \dfrac{56}{\cancel{99}} \times \dfrac{\overset{717}{\cancel{70983}}}{1} = 40152s. = £2007 \; 12s.$

Younger son's portion $=£3549 \; 3s. - £2007 \; 12s. = £1541 \; 11s.$

(8)...4 per cent. $= \frac{1}{25}$ of 100

$\frac{1}{2}$,, ,, $= \frac{1}{8}$ of 4

	£	s.	d.
	1642	10	0
	65	14	0
	8	4	3
	£73	18	3	= 1 year's int.

From March 10, 1861, to September 26, 1863 = 930 days

$$\overset{\text{da.}}{365} \;:\; \overset{\text{da.}}{930} \;::\; \overset{£\quad s.\quad d.}{73 \;\; 18 \;\; 3} \;:\; x$$

$$\frac{20}{1478}$$

$$\frac{12}{17739}$$

$$x = \frac{\overset{186}{\cancel{930}} \times \overset{243}{\cancel{17739}}}{\underset{73}{\cancel{365}}} = 45198d. = £188 \; 6s. \; 6d.$$

(9)...5 per cent.$=\frac{1}{20}$ of 100

	£	s.	d.	
	666	13	4	
	33	6	8	int. for 1st year
	700	0	0	prin. at end of 1st yr.
	35	0	0	int. for 2nd year
,, ,,	735	0	0	prin. at end of 2nd yr.
	36	15	0	int. for 3rd year
,, ,,	771	15	0	prin. at end of 3rd yr.
	38	11	9	int. for 4th year
	810	6	9	prin. at end of 4th yr.
	666	13	4	original principal
	£143	13	5	compound interest

(10)... 840 : 56 14 :: 100 : 6¾ per cent.
(£) (£ s.) (£)

EXERCISE XCIV.

(1)...

2)7 9 14 18 21
3)7 9 7 9 21
3)7 3 7 3 7
7)7 1 7 1 7
  1 1 1 1 1

L.C.M. $= 2 \times 3 \times 3 \times 7 = 126$

2)7 14 15 30
  7   15

L.C.D. $= 2 \times 7 \times 15 = 210$

$\therefore \frac{6}{7}, \frac{11}{14}, \frac{13}{15}, \frac{23}{30} = \frac{180}{210}, \frac{165}{210}, \frac{182}{210}, \frac{161}{210}$

(2)...

$$\frac{11}{17} = \frac{11 \times 21}{15 \times 17} = \frac{77}{85} ; \quad \frac{15\frac{7}{9}}{23\frac{3}{10}} = \frac{\frac{142}{9}}{\frac{233}{10}} = \frac{142 \times 10}{233 \times 9} = \frac{1420}{2097} ;$$

$$27\frac{3}{11} \div 63\frac{1}{3} = \frac{\frac{300}{11}}{\frac{190}{3}} = \frac{300 \times 3}{190 \times 11} = \frac{90}{209}$$

(3)... $7\frac{5}{9} \times 2\frac{4}{5} \times \frac{11}{17} \times 2\frac{3}{8} \times 7\frac{1}{3} \times 3\frac{2}{11} \times 4\frac{5}{19} \times 1\frac{5}{7} \times 3\frac{3}{16} \times \frac{2}{17}$

$$= \frac{\overset{4}{\cancel{68}}}{\cancel{9}} \times \frac{\overset{2}{\cancel{14}}}{\cancel{5}} \times \frac{\cancel{11}}{\cancel{17}} \times \frac{\cancel{19}}{\underset{2}{\cancel{8}}} \times \frac{\overset{11}{\cancel{22}}}{\cancel{3}} \times \frac{\overset{7}{\cancel{35}}}{\cancel{11}} \times \frac{\overset{9}{\cancel{81}}}{\cancel{19}} \times \frac{\overset{.3}{\cancel{12}}}{\cancel{7}} \times \frac{\overset{\cancel{3}}{\cancel{51}}}{\underset{4}{\cancel{16}}} \times \frac{2}{\cancel{17}}$$

$$= 2079$$

(4)...

			s.	d.		s.	d.
$\frac{7}{11}$	of	17	5	=		11	1
$\frac{3}{10}$	of	17	11	=		5	$4\frac{1}{2}$
$\frac{5}{12}$	of	14	9	=		6	$1\frac{3}{4}$
					£1	2	$7\frac{1}{4}$

(5)...

				ac.	ro.	per.
$\frac{8}{15}$	of 12 ac. 1 ro. 20 per.	=		6	2	16
$\frac{23}{40}$	of 7 ac. 3 ro.	=		4	1	33
			ac.	2	0	23 per.

(6)...   1. x : 1105 :: 43 : 65

$$x = \frac{\overset{17}{\cancel{1105}} \times 43}{\cancel{65}} = 731$$

2. $7\frac{9}{11}$: x :: $34\frac{2}{5}$: $50\frac{7}{30}$

$$x = (7\frac{9}{11} \times 50\frac{7}{30}) \div 34\frac{2}{5}$$

$$= \frac{\cancel{86}}{\cancel{11}} \times \frac{\overset{137}{\cancel{1507}}}{\underset{6}{\cancel{30}}} \times \frac{\cancel{5}}{\underset{2}{\cancel{172}}} = \frac{137}{12} = 11\frac{5}{12}$$

3. $17{\cdot}06$: $29{\cdot}18$ :: x : $154{\cdot}654$

$$x = \frac{17{\cdot}06 \times \overset{5{\cdot}3}{\cancel{154{\cdot}654}}}{\cancel{29{\cdot}18}} = 90{\cdot}418$$

4. ${\cdot}057$: $3{\cdot}49$ :: ${\cdot}01653$: x

$$x = \frac{3{\cdot}49 \times \overset{{\cdot}29}{\cancel{{\cdot}01653}}}{\cancel{{\cdot}057}} = 1{\cdot}0121$$

(7)...
$$\begin{array}{ccccccc} \text{ac.} & & \text{ac.} & & £ & & \\ 1 & : & 93\tfrac{19}{32} & :: & 2\tfrac{5}{12} & : & x \end{array}$$

$$x = \tfrac{2995}{32} \times \tfrac{29}{12} = £\tfrac{86855}{384} = £226\ 3s.\ 8\tfrac{3}{8}d.$$

(8)...
$$\begin{array}{rl} 75 \text{ sheep at 2 guineas each} =& £157\ 10s. \\ \text{cost} =& £135 \\ \hline \text{profit} =& £22\ 10s. \end{array}$$

$$\begin{array}{ccccccc} £ & & £ & s. & & & \\ 135 & : & 22 & 10 & :: & 100 & : & 16\tfrac{2}{3} \text{ per cent.} \end{array}$$

(9)...
$$\begin{array}{ccccccccc} \text{yds.} & \text{in.} & & \text{yds.} & \text{in.} & & £ & s. & d. & \\ 27\tfrac{1}{2}\times 24 & : & & 38\tfrac{3}{4}\times 27 & :: & & 4 & 11 & 8 & : & x \\ 4 & & & 4 & & & 20 & & & \\ \hline 110 & & & 155 & & & 91 & & & \\ & & & & & & 12 & & & \\ & & & & & & \hline & & & \\ & & & & & & 1100 & & & \end{array}$$

$$x = \frac{155 \times \cancel{27}^{9} \times \cancel{1100}^{\overset{5}{\cancel{10}}}}{\cancel{110}^{\cancel{10}} \times \cancel{24}^{\underset{4}{\cancel{8}}}} = 6975 \text{ far.} = £7\ 5s.\ 3\tfrac{3}{4}d.$$

(10)...
```
924490326617764(9615042
81
186)11744
    1116
  1921) 2890
        1921
     19225) 96932
           96125
        1923004) 8076617
                7692016
           19230082) 38460164
                     38460164
```

EXERCISE XCV.

			s.	d.		£	s	d.

(1)... $43\frac{1}{2}$ yds. Welsh Flannel 2   3   = 4   17 $10\frac{1}{2}$
$37\frac{1}{2}$ „   Linen Sheeting ......1 10   = 3   8   9
39 „   Calico ....0 $9\frac{1}{2}$ = 1   10 $10\frac{1}{2}$
$17\frac{3}{4}$ „   French Merino 3   8   = 3   5   1
$2\frac{3}{4}$ „   Silk Velvet...........7   6   = 1   0 $7\frac{1}{2}$

£14   3 $2\frac{1}{2}$

(2)...   A can reap $\frac{1}{5}$ in 1 day
B   „ $\frac{4}{25}$ „
C   „ $\frac{1}{7}$ „

∴ A+B+C can reap $\frac{1}{5}+\frac{4}{25}+\frac{1}{7}$ in 1 day

$$\frac{1}{5}+\frac{4}{25}+\frac{1}{7} = \frac{35+28+25}{175} = \frac{88}{175}$$

$\frac{88}{175}$:   1   ::   1 day   : $1\frac{87}{88}$ days

(3)... $74\cdot6875 = 74\frac{6875}{10000} = 74\frac{11}{16}$

$3\frac{2}{3}s. \times 74\frac{11}{16} = \frac{11}{3} \times \frac{1195}{16} = \frac{13145}{48}s. = £13\ 13s.\ 10\frac{1}{4}d.$

(4)...   6 hours $22\frac{1}{2}$ min. = $6\cdot375$ hours

$6\cdot375)22\cdot3125(3\cdot5 = 3\frac{1}{2}$ miles per hour
19125
31875
31875

(5)... $6\frac{1}{2}$ guineas = £6 16s. 6d. = $£6\frac{33}{40}$

$$£6\frac{33}{40} \times 2\frac{10}{21} \times 5 = \frac{273}{40} \times \frac{52}{21} \times \frac{5}{1} = £\frac{169}{2} = £84\ 10s.$$

(6)... $75\frac{1}{2}$ lb. at 9d. per lb. = £2 16 $7\frac{1}{2}$
$75\frac{1}{2}$ lb. at 70s. per cwt. = £2   7 $2\frac{1}{4}$
profit =   9s. $5\frac{1}{4}d$.

£ s. d. s. d.
2 7 $2\frac{1}{4}$: 9 $5\frac{1}{4}$ :: 100 : 20 per cent.

(7)... 4 per cent. = $\frac{1}{25}$ of 100)917 14 2 £ s. d.
36 14 2 int. for 1 year
$6\frac{3}{4}$
220 5 0
$\frac{1}{2}$ year = 18 7 1
$\frac{1}{4}$ year = 9 3 $6\frac{1}{2}$
£247 15 $7\frac{1}{2}$ int. for $6\frac{3}{4}$ years

(8)...   £ s. d.
. 651 11 3 amount
562 10 0 principal
£89 1 3 int. for 3 years 4 mo.

£89 1s. 3d.÷$3\frac{1}{3}$ = £26 14s. $4\frac{1}{2}d$. int. for 1 year

£ s.   £   £ s. d.   £
562 10 : 100 :: 26 14 $4\frac{1}{2}$ :: $4\frac{3}{4}$ per cent.

(9)...   3·0000000000(1·73205 . . . . .
1
27)200
189
343) 1100
1029
3462) 7100
6924
346405) 1760000
1732025
27975

(10)...   Let x = the mean proportional

then $108 \; : \; x \; :: \; x \; : \; 243$

$$\therefore x^2 = 108 \times 243$$
$$= 26244$$

and $x = 162$

EXERCISE XCVI.

(1)...

$$
\begin{array}{r}
2)\underline{7\ \ 10\ \ 14\ \ 18\ \ 25} \\
5)\underline{7\ \ \ 5\ \ \ 7\ \ \ 9\ \ 25} \\
7)\underline{7\ \ \ 1\ \ \ 7\ \ \ 9\ \ \ 5} \\
\overline{1\ \ \ 1\ \ \ 1\ \ \ 9\ \ \ 5}
\end{array}
$$

L.C.M. $= 2 \times 5 \times 7 \times 9 \times 5 = 3150$

(2)...

$$5\tfrac{2}{9} - (\tfrac{7}{11} \text{ of } \tfrac{5}{9} \text{ of } 4\tfrac{5}{7})$$

$$5\tfrac{2}{9} - \left(\frac{7}{11} \times \frac{5}{9} \times \frac{33}{7} \right)$$

$$5\tfrac{2}{9} - \tfrac{5}{3} = 5\tfrac{2}{9} - 1\tfrac{6}{9} = 3\tfrac{5}{9}$$

(3)...

$$\frac{72\tfrac{4}{9}}{84} = \frac{652}{756} = \frac{163}{189} ; \qquad \frac{88}{100\tfrac{4}{5}} = \frac{440}{504} = \frac{55}{63}$$

$$\frac{72\tfrac{4}{9}}{84} \div \frac{88}{100\tfrac{4}{5}} = \frac{163}{189} \times \frac{63}{55} = \frac{163}{165}$$

(4)...

$$\left(\frac{1}{14} \text{ of } \frac{13}{24} \right) \text{ gui.} = \frac{1}{14} \times \frac{13}{24} \times \frac{252}{1} = \frac{39}{4}d. = 9\tfrac{3}{4}d.$$

$9\tfrac{3}{4}d. = $ 39 farthings $\frac{39}{120} = \frac{13}{40}$ of half-a-crown

$2s.\ 6d. = $ 120   ,,

(5)...
$$\frac{13}{28}\text{ gui.} = \frac{13}{\cancel{28}_4} \times \frac{\overset{3}{\cancel{21}}}{1} = \frac{39}{4} = 9s.\ 9d.$$

$$12)9$$
$$20)\overline{9\cdot75}$$
$$9s.\ 9d. = \overline{\cdot4875}\text{ of a sov.}$$

a sovereign $= \frac{20}{21}$ of a guinea

$$\therefore \frac{7}{32}\text{ sov.} = \frac{7}{\cancel{32}_8} \times \frac{\overset{5}{\cancel{20}}}{\cancel{21}_3} = \frac{5}{24}\text{ of a guinea}$$

(6)...
$$52\tfrac{1}{2}\text{ lb. Coffee at } 14d. = 735d.$$
$$2s.\ 11d. \times 75 \times 7 = 18375d.$$
$$18375 \div 735 = 25\text{ bags}$$

(7)...

men	da.	hrs.		men	da.	hrs.		£	s.	d.		
$5 \times 9 \times 8\tfrac{1}{2}$			:	$11 \times 13\tfrac{1}{2} \times 10$			::	9	11	3	:	x

$$\frac{5 \times 9 \times 8\tfrac{1}{2}}{2\quad2} \quad \frac{11 \times 13\tfrac{1}{2} \times 10}{2\quad2}$$
$$\overline{18}\ \overline{17} \qquad \overline{27}\ \overline{20}$$

$$\begin{array}{c}20\\\hline 191\\12\\\hline 2295\end{array}$$

$$x = \frac{11 \times \overset{3}{\cancel{27}} \times \overset{\overset{2}{\cancel{4}}}{\cancel{20}} \times \overset{135}{\cancel{2295}}}{\cancel{5} \times \cancel{18} \times \cancel{17}} = 8910d. = £37\ 2s.\ 6d.$$

(8)...
$$86\tfrac{5}{8} - 77 = 9\tfrac{5}{8} = \text{gain upon } £77$$

$$\begin{array}{ccccccc} £ & & £ & & £ & & \\ 77 & : & 1325 & :: & 9\tfrac{5}{8} & : & \text{whole gain}\end{array}$$

$$\text{whole gain} = \frac{1}{\cancel{77}} \times \frac{1325}{1} \times \frac{\cancel{77}}{8} = £\frac{1325}{8} = £165\ 12s.\ 6d.$$

(9)...

$$
\begin{array}{cc}
 & s. \quad d. \\
 & 4 \quad 8 \text{ per square yard} \\
 & 5 \times 9 = 45 \\
\hline
 & 1 \quad 3 \quad 4 \\
 & \quad\quad 9 \\
\hline
 & 10 \quad 10 \quad 0
\end{array}
$$

4 sq. ft. 72 sq. in. = ½ yd. =   2   4
1 sq. ft. 18 sq. in. = ⅛ yd. =   7

$$\overline{£10 \quad 12 \quad 11}$$

(10)... $20 \cdot 000000000000 (2 \cdot 7144 \ldots\ldots$

$$
\begin{array}{r}
8 \\
2^2 \times 300 = 1200 \overline{)\,12000} \\
8400 = 1200 \times 7 \\
2940 = 2 \times 30 \times 7^2 \\
343 = 7^3 \\
\hline
11683 \text{ subtrahend} \\
27^2 \times 300 = 218700 \overline{)\quad 317000} \\
218700 = 218700 \times 1 \\
810 = 27 \times 30 \times 1^2 \\
1 = 1^3 \\
\hline
219511 \text{ subtrahend} \\
271^2 \times 300 = 22032300 \overline{)\;97489000} \\
88129200 = 22032300 \times 4 \\
130080 = 271 \times 30 \times 4^2 \\
64 = 4^3 \\
\hline
88259344 \text{ subtrahend} \\
2714^2 \times 300 = 2209738800 \overline{)9229656000} \\
8838955200 = 2209738800 \times 4 \\
1302720 = 2714 \times 30 \times 4^2 \\
64 = 4^3 \\
\hline
8840257984 \text{ subtrahend} \\
\hline
389398016
\end{array}
$$

EXERCISE XCVII.

(1)... $\dfrac{7}{9} + \dfrac{5}{14} + \dfrac{11}{12} = \dfrac{196 + 90 + 231}{252} = \dfrac{517}{252} = 2\tfrac{13}{252}$

$3\tfrac{7}{12} - 2\tfrac{13}{252} = 3\tfrac{147}{252} - 2\tfrac{13}{252} = 1\tfrac{134}{252} = 1\tfrac{67}{126}$

(2)...

$$
\begin{array}{rrr}
\pounds & s. & d. \\
39 & 6 & 11 \\
\end{array}
$$

$7 \times 8 + 3 = 59$

$$
\begin{array}{rrr}
\hline
275 & 8 & 5 \\
 & & 8 \\
\hline
2203 & 7 & 4 \\
118 & 0 & 9 \\
19 & 13 & 5\tfrac{1}{2} \\
5 & 12 & 5 \\
\hline
\pounds 2346 & 13 & 11\tfrac{1}{2} \\
\end{array}
$$

$\tfrac{7}{14}$ or $\tfrac{1}{2} =$

$\tfrac{2}{14}$ or $\tfrac{1}{7} =$

(3)...

$$
\begin{array}{rrr}
\pounds & s. & d. \\
1107 & 0 & 9\tfrac{1}{2} \\
 & & 16 \\
\end{array}
$$

$43\tfrac{3}{16} \times 16 = 691)\overline{17712\ \ 12\ \ 8}(\pounds 25\ 12s.\ 8d.$

$\quad\quad\quad\quad\quad 1382$

$\quad\quad\quad\quad\overline{3892}$

$\quad\quad\quad\quad 3455$

$\quad\quad\quad\quad\overline{437}$

$\quad\quad\quad\quad\quad 20$

$691)\overline{8752}(12s.$

$\quad\quad 8292$

$\quad\quad\overline{460}$

$\quad\quad\ 12$

$691)\overline{5528}(8d.$

$\quad\quad 5528$

(4)...

$$29 \cdot 73) 782 \cdot 46000 (26 \cdot 318 \dots\dots$$

    5946
    ─────
    18786
    17838
    ─────
     9480
     8919
     ────
      5610
      2973
      ────
      26370
      23784
      ─────
       2586

$$\cdot 2973) 78 \cdot 2460000 (263 \cdot 188 \dots\dots$$

    5946
    ─────
    18786
    17838
    ─────
     9480
     8919
     ────
      5610
      2973
      ────
      26370
      23784
      ─────
       25860
       23784
       ─────
        2076

(5)...

                 cwt.

7 cwt. 2 qrs. = 7·5

       ·6875
      ─────
     34375
    48125
    ──────
   5·15625 cwt. = 5 cwt. 17½ lb.

            4   lb.
     ─────
   ·62500   28)14
       28   4) 3·5
 ───────   ─────
17·50000 lb.   20) 5·875
        16   5 cwt. 3 qrs. 14 lb. = ·29375 of a ton
 ────────
 8·00000 oz.

(6)...
$$\begin{array}{ccc} & s. & d. & \pounds & s. \\ \end{array}$$

220 qrs. at 51 0 = 561 0
350 qrs. at 52 6 = 918 15
180 qrs. at 54 0 = 486 0

$\pounds$1965 15 selling price
750 qrs. at 47 6 = 1781 5 cost price
$\pounds$184 10 profit

(7)...
$$\begin{array}{cccccc} & s. & d. & \pounds & s. & d. \end{array}$$

80 lb. of tea at 3 10 = 15 6 8
cost 13 6 8
$\pounds$2 0 0

$$\begin{array}{ccc} \pounds & s. & d. & \pounds \\ 13 & 6 & 8 & : & 2 & :: & 100 & : & 15 \text{ per cent.} \end{array}$$

$$\begin{array}{ccc} & \pounds & s. & d. \end{array}$$
112 lb. of sugar at 5$\frac{1}{2}$d. = 2 11 4
cost 2 6 8
profit 4 8

$$\begin{array}{ccccc} \pounds & s. & d. & s. & d. \\ 2 & 6 & 8 & : & 4 & 8 & :: & 100 & : & 10 \text{ per cent.} \end{array}$$

The tea yields 15 per cent. profit, and the sugar 10 per cent.

(8)...
$$\begin{array}{ccc} \pounds & s. & d. \end{array}$$
107 11 4 amount
96 0 10 principal
$\pounds$11 10 6 interest

$$\begin{array}{ccc} & \pounds & s. & d. \end{array}$$
4 per cent. = $\frac{1}{25}$ of 100 | 96 0 10
$\frac{1}{2}$ per cent. = $\frac{1}{8}$ of 4 | 3 16 10
9 7$\frac{1}{4}$

$\pounds$4 6 5$\frac{1}{4}$ interest for 1 year

$$\begin{array}{ccccc} \pounds & s. & d. & \pounds & s. & d. & yr. & yrs. \\ 4 & 6 & 5\frac{1}{4} & : & 11 & 10 & 6 & :: & 1 & : & 2\frac{2}{3} & = 2 \text{ yrs. 8 mo.} \end{array}$$

(9)...
$$6513\dot4\dot6\dot650\dot66025(8070605$$
$$64$$
$$1607)\overline{11346}$$
$$11249$$
$$161406)\overline{976506}$$
$$968436$$
$$16141205)\overline{80706025}$$
$$\underline{80706025}$$

(10)...   Let x = the mean proportional

Then 47 : x :: x : $105\frac{3}{4}$

$$\therefore \; x^2 = 47 \times 105\frac{3}{4}$$
$$= 4970 \cdot 25$$
$$\text{and } x = 70 \cdot 5 = 70\frac{1}{2}$$

EXERCISE XCVIII.

(1)...

mi.		mi.		ho.	min.		
$7\frac{1}{2}$	:	$26\frac{1}{2}$	::	4	45	:	x
2		2			60		
$\overline{15}$		$\overline{53}$			$\overline{285}$		

$$x = \frac{53 \times \overset{19}{\cancel{285}}}{\cancel{15}} = 1007 \text{ min.} = 16 \text{ hrs. } 47 \text{ min.}$$

(2)...

cwt.	qrs.	lb.		cwt.	qrs.	lb.		£	s.	d.		
3	2	18	:	2	3	22	::	31	12	1	:	x
		4				4				20		
	$\overline{14}$				$\overline{11}$				$\overline{632}$			
		28				28				12		
	$\overline{410}$				$\overline{330}$				$\overline{7585}$			

$$x = \frac{\overset{33}{\cancel{330}} \times \overset{185}{\cancel{7585}}}{\underset{\underset{41}{\cancel{41}}}{\cancel{410}}} = 6105d. = £25 \; 8s. \; 9d.$$

(3)...

$$
\begin{array}{r}
19 \cdot 234 \\
\cdot 7 \cdot 465 \\
\hline
11 \cdot 769 \\
\cdot 0065 \\
\hline
58845 \\
70614 \\
\hline
\cdot 0764985
\end{array}
$$

(4)... $£13\frac{5}{12} = £13 \; 8s. \; 4d.$ $3 \cdot 0625 = 3\frac{1}{16}$

	£	s.	d.
	13	8	4
			3
	$\overline{40}$	5	0
$\frac{1}{16} =$		16	$9\frac{1}{4}$
	$£41$	1	$9\frac{1}{4}$

(5)... 1. 2 qrs. = ½ of 1 cwt.

	£	s.	d.	
	1	17	4	per cwt.
			7	
	13	1	4	
		18	8	
		4	8	
		1	4	
	£14	6	0	

14 lb. = ¼ of 2 qrs.
4 lb. = $\frac{1}{14}$ of 2 qrs.

2. 10 cwt. = ½ of 1 ton

	£	s.	d.	
	0	13	4	per ton
			$5 \times 5 = 25$	
	3	6	8	
			5	
	16	13	4	
		6	8	
			10	
			4	
	£17	1	2	

1¼ cwt. = ⅛ of 10 cwt.
½ cwt. = $\frac{1}{20}$ of 10 cwt.

3. 44 guineas =

	£	s.	d.	
	46	4	0	per acre
			$3 \times 6 + 1 = 19$	
	138	12	0	
			6	
	831	12	0	
	46	4	0	
	23	2	0	
	11	11	0	
	5	15	6	
	2	17	9	
		14	5¼	
	£921	16	8¼	

2 roods = ½ of 1 acre
1 rood = ½ of 2 roods
20 poles = ½ of 1 rood
10 poles = ½ of 20 poles
2½ poles = ¼ of 10 poles

(6)...

$$35\tfrac{7}{10} \text{ E. ells} = \frac{357}{\cancel{10}_{2}} \times \frac{\cancel{5}}{4} = \frac{357}{8} = 44\tfrac{5}{8} \text{ yards}$$

$$44\tfrac{5}{8} \text{ yds.} \div 3\tfrac{3}{16} \text{ yds.} = \frac{\overset{7}{\cancel{357}}}{\cancel{8}} \times \frac{\overset{2}{\cancel{16}}}{\cancel{51}} = 14 \text{ shirts}$$

(7)...

$$\overset{s.}{\cdot 5625} = 6\tfrac{3}{4}d.$$
$$\underline{12}$$
$$\overline{6\cdot 7500}d.$$
$$\underline{4}$$
$$\overline{3\cdot 0000}\text{ far.}$$

$$\overset{cwt.}{\cdot 578125} = 2\text{ qrs. }8\text{ lb. }12\text{ oz.}$$
$$\underline{4}$$
$$\overline{2\cdot 312500}\text{ qrs.}$$
$$\underline{28}$$
$$\overline{8\cdot 750000}\text{ lb.}$$
$$\underline{16}$$
$$\overline{12\cdot 000000}\text{ oz.}$$

oz.		qr.	lb.	oz.		d.		
3	:	2	8	12	:	$6\tfrac{3}{4}$	:	x
		28				4		
		$\overline{64}$				$\overline{27}$		
		16						
		$\overline{1036}$						

$$x = \frac{1036 \times \overset{9}{\cancel{27}}}{\underset{\cancel{3}}{}} = 9324\text{ far.} = \pounds 9\ 14s.\ 3d.$$

(8)...Amount of £100 in $3\tfrac{1}{3}$ years at 5 per cent. per annum
$$= \pounds 100 + (\pounds 5 \times 3\tfrac{1}{3}) = \pounds 116\ 13s.\ 4d.$$

£	s.	d.		£	s.	d.		£		£	s.	d.
116	13	4	:	482	5	5	::	100	:	413	7	6

(9)...

	£	s.	d.	
	400	0	0	principal
$\tfrac{1}{2}$ year's int. at 5 per cent.=	10	0	0	int. for 1st half-year
	410	0	0	prin. at end of 1st hf.-yr.
,, ,,	10	5	0	int. for 2nd half-year
	420	5	0	prin. at end of 2nd hf.-yr.
,, ,,	10	10	$1\tfrac{1}{2}$	int. for 3rd half-year
	430	15	$1\tfrac{1}{2}$	prin. at end of 3rd hf.-yr.
,, ,,	10	15	$4\tfrac{43}{80}$	int. for 4th half-year
	441	10	$6\tfrac{3}{80}$	prin. at end of 4th hf.-yr.
,, ,,	11	0	$9\tfrac{483}{3200}$	int. for 5th half-year
	£452	11	$3\tfrac{603}{3200}$	amount in $3\tfrac{1}{2}$ years

(10)...

$$\frac{7}{12} = \cdot 583333333333 \ldots \ldots (\cdot 763762 \ldots \ldots$$

```
                    49
          146) 933
               876
        1523) 5733
               4569
      15267)116433
              106869
    152746)  956433
             916476
   1527522)  3995733
             3055044
              940689
```

EXERCISE XCIX.

(1)...

```
5989)7571(1
     5989
     1582)5989(3
           4746
          1243)1582(1
               1243
                339)1243(3
                    1017
                     226)339(1
                     226
                      113)226(2
                      226
113)8927(79
    791
   1017
   1017
```

G.C.M. = 113

```
2)6   8   9  12  14  18  21
2)3   4   9   6   7   9  21
3)3   2   9   3   7   9  21
3)1   2   3   1   7   3   7
7)1   2   1   1   7   1   7
   1   2   1   1   1   1   1
```

L.C.M. = 2 × 2 × 3 × 3 × 7 × 2 = 504

Q

(2)... $3\frac{2}{7} \times \frac{9}{10} \times 1\frac{5}{9} \times 2\frac{6}{7} \times \frac{8}{11} \times \frac{15}{23} \times 1\frac{2}{5} \times \frac{11}{16}$

$$= \frac{23}{7} \times \frac{9}{10} \times \frac{14}{9} \times \frac{20}{7} \times \frac{8}{11} \times \frac{15}{23} \times \frac{7}{5} \times \frac{11}{16}$$

$$= 6$$

(3)... $10\frac{1}{2} \div (\tfrac{4}{7} \text{ of } \tfrac{5}{8})$

$$= \frac{21}{2} \times \frac{7}{4} \times \frac{8}{5} = \frac{147}{5} = 29\frac{2}{5}$$

(4)...
$$11s.\ 1d. = 133 \text{ pence}$$
$$1 \text{ guinea} = 252 \text{ pence}$$
$$\tfrac{133}{252} \div 7 = \tfrac{19}{36} \text{ of a guinea}$$

$$\frac{77}{96}\text{ sov.} = \frac{77}{96} \times \frac{20}{1} = \frac{385}{24}s. = 16s.\ 0\tfrac{1}{2}d.$$

(5)...
$$\frac{13}{18}\text{ gui.} = \frac{13}{18} \times \frac{21}{1} = \frac{91}{6} = \quad \begin{array}{cc} s. & d. \\ 15 & 2 \end{array}$$

$$\frac{19}{24}\text{ sov.} = \frac{19}{24} \times \frac{20}{1} = \frac{95}{6} = \quad 15\ \ 10$$

$$\frac{7}{12}\text{ cr.} = \frac{7}{12} \times \frac{5}{1} = \frac{35}{12} = \quad 2\ \ 11$$

$$\frac{13}{16}\text{ fl.} = \frac{13}{16} \times \frac{2}{1} = \frac{13}{8} = \quad 1\ \ 7\tfrac{1}{2}$$

$$\frac{29}{48} = \frac{\quad 7\tfrac{1}{4}}{£1\ \ 16\ \ 1\tfrac{3}{4}}$$

(6)...

$$\frac{7}{16} \text{ yard} = \frac{7}{\cancel{16}_4} \times \frac{\cancel{36}^9}{1} = \frac{63}{4} \text{ in.} = 15\frac{3}{4} \text{ in.}$$

$$\frac{13}{24} \text{ foot} = \frac{13}{\cancel{24}_2} \times \frac{\cancel{12}}{1} = \frac{13}{2} \text{ in.} = \begin{array}{c} 6\frac{1}{2} \text{ in.} \\ \hline 9\frac{1}{2} \text{ inches} \end{array}$$

(7)...

$$1 \text{ sov.} = \frac{20}{21} \text{ of a guinea}$$

$$\therefore \frac{35}{48} \text{ sov.} = \frac{\cancel{35}^5}{\cancel{48}_{12}} \times \frac{\cancel{20}^5}{\cancel{21}_3} = \frac{25}{36} \text{ of a guinea}$$

$$1 \text{ guinea} = \frac{21}{20} \text{ of a sovereign}$$

$$\therefore \frac{35}{48} \text{ gui.} = \frac{\cancel{35}^7}{\cancel{48}_{16}} \times \frac{\cancel{21}^7}{\cancel{20}_4} = \frac{49}{64} \text{ of a sovereign}$$

(8)...

$$\frac{19}{32} \text{ cwt.} = \frac{19}{\cancel{32}_2} \times \frac{\cancel{112}^7}{1} = \frac{133}{2} = 66\frac{1}{2} \text{ lb.}$$

$$\begin{array}{ccccccc} \text{lb.} & & \text{lb.} & & \pounds & & \\ 17\frac{5}{6} & : & 66\frac{1}{2} & :: & \frac{107}{160} & : & x \end{array}$$

$$x = \frac{\cancel{6}^3}{\cancel{107}} \times \frac{133}{2} \times \frac{\cancel{107}}{\cancel{160}_{80}} = \pounds\frac{399}{160} = \pounds 2 \ 9s. \ 10\frac{1}{2}d.$$

(9)...   A + B can reap $\frac{2}{25}$ of an acre in 1 hour

A can reap $\frac{2}{45}$,,   ,,   ,,

$$\therefore \text{ B can reap } \frac{2}{25} - \frac{2}{45} = \frac{18-10}{225} = \frac{8}{225} \text{ in 1 hour}$$

B would reap an acre in $\frac{225}{8} = 28\frac{1}{8}$ hours

Q 2

$$(10)\ldots \quad \begin{array}{cc} \text{yd.} & \text{in.} \\ 1\frac{7}{8} \text{ or } 67\frac{1}{2} \end{array} \quad : \quad \begin{array}{c} \text{in.} \\ 25 \end{array} \quad :: \quad \begin{array}{c} \text{yds.} \\ 47\frac{1}{4} \end{array} \quad : \quad x$$

$$x = \frac{\overset{2}{\cancel{7}}}{\underset{27}{\cancel{135}}} \times \frac{\overset{5}{\cancel{25}}}{1} \times \frac{\overset{7}{\cancel{189}}}{\underset{2}{\cancel{4}}} = \frac{35}{2} \text{ yds.} = 17\frac{1}{2} \text{ yards}$$

EXERCISE C.

(1)...Time occupied in walking $= 35 \div 3\frac{3}{4} = 9$ hrs. 20 min.

9 hrs. 20 min. $+$ 20 min. $+$ 15 min. $=$ 9 hrs. 55 min.

	hrs.	min.	
Time of starting	6	30	A. M.
Time occupied by journey	9	55	
Time of arrival at Henley	4	25	P. M.

(2)...

$$\begin{array}{r} 66564(258 \\ 4 \\ \hline 45)\overline{265} \\ 225 \\ \hline 508)\overline{4064} \\ 4064 \end{array} \qquad \begin{array}{r} 258)123582(479 \\ 1032 \\ \hline 2038 \\ 1806 \\ \hline 2322 \\ 2322 \end{array}$$

∴ the numbers are 258 and 479

(3)... $\quad \cdot072 = \frac{72}{1000} = \frac{9}{125}; \quad \cdot1065 = \frac{1065}{10000} = \frac{213}{2000};$

$\cdot00625 = \frac{625}{100000} = \frac{1}{16}$

(4)...

$$\begin{array}{l} 17 \cdot 1875s. = 17s.\ 2\frac{1}{4}d. \\ 12 \\ \hline 2 \cdot 2500d. \\ 4 \\ \hline 1 \cdot 0000 \text{ far.} \end{array} \qquad \begin{array}{l} 5 \cdot 3125 \text{ cr.} = 26s.\ 6\frac{3}{4}d. \\ 5 \\ \hline 1 \cdot 5625s. \\ 12 \\ \hline 6 \cdot 7500d. \\ 4 \\ \hline 3 \cdot 0000 \text{ far.} \end{array}$$

26s. $6\frac{3}{4}d.$ — 17s. $2\frac{1}{4}d.$ = 9s. $4\frac{1}{2}d.$

(5)...
$$24)\overline{12}^{\text{ grs.}}$$
$$20)\overline{10\cdot5}$$
$$12)\ \overline{6\cdot525}$$

6 oz. 10 dwts. 12 grs. = ·54375 of a lb. Troy

(6)...   Perimeter of field = $(216+146)\times2$ = 724 yards

724 yards at 1s. $2\frac{1}{2}d$. per yard = £43 14s. 10d.

(7)...
men da.		men da.		ac. per.		
$5\times4\frac{1}{2}$	:	$9\times3\frac{3}{4}$	::	14 10	:	x
4		4		160		
$\overline{18}$		$\overline{15}$		$\overline{2250}$		

$$x = \frac{9 \times \overset{3}{\cancel{15}} \times \overset{125}{\cancel{2250}}}{\cancel{5} \times \cancel{18}} = 3375 \text{ perches} = 21 \text{ ac. } 15 \text{ per.}$$

(8)...
£		£		£		
$93\frac{1}{2}$	:	1650	::	$4\frac{1}{4}$	:	yearly income
4				4		
$\overline{374}$				$\overline{17}$		

$$\text{yearly income} = \frac{\overset{75}{\cancel{1650}} \times \cancel{17}}{\cancel{374} \\ \cancel{22}} = £75$$

(9)...   5s. 3d. per dozen = 63s. per gross

$$\begin{array}{r} 45s. \\ \hline \text{profit} = 18s. \text{ per gross} \end{array}$$

s.		s.				
45	:	18	::	100	:	gain per cent.

$$\text{gain} = \frac{\overset{2}{\cancel{18}} \times \overset{20}{\cancel{100}}}{\cancel{45} \\ \cancel{5}} = 40 \text{ per cent.}$$

(10)...

$$714285283716(845154$$
$$64$$
$$\overline{164)\ 742}$$
$$656$$
$$\overline{1685)\ 8685}$$
$$8425$$
$$\overline{16901)\ 26028}$$
$$16901$$
$$\overline{169025)\ 912737}$$
$$845125$$
$$\overline{1690304)\ 6761216}$$
$$6761216$$
$$\overline{}$$

EXERCISE CI.

(1)...

$$\begin{array}{cc} s. & d. \\ 23 & 6 \end{array}$$
$$7 \times 9 = 63$$
$$\overline{\begin{array}{cc} 164 & 6 \end{array}}$$
$$9$$
$$\overline{21)1480\quad 6}$$

$70\frac{1}{2}$ gallons of brandy *and water*
63 gallons of brandy
$\overline{\ 7\frac{1}{2}}$ gallons of water

(2)...

$$\begin{array}{ccccccc} \text{ac.} & & \text{ac.} & \text{ro.} & \text{per.} & & s. \\ 1 & : & 237 & 3 & 20 & :: & 42 & : & x \\ 4 & & 4 \\ \overline{4} & & \overline{951} \\ 40 & & 40 \\ \overline{160} & & \overline{38060} \end{array}$$

$$\begin{array}{cc} 1903 & 21 \end{array}$$

$$x = \frac{\cancel{38060} \times \cancel{42}}{\cancel{160}} = \frac{39963}{4}s. = \pounds499\ 10s.\ 9d.$$

$$\begin{array}{c} \cancel{8} \\ 4 \end{array}$$

$1s.\ 8d. = \frac{1}{12}$ of $\pounds1$)
$$\begin{array}{ccc} \pounds & s. & d. \\ 499 & 10 & 9 \end{array} \text{ rent of land}$$
$$\overline{\pounds41\ \ 12\ \ \ 6\tfrac{3}{4}} \text{ amount of poor rate}$$

(3)...

$$\begin{array}{cc} \pounds & s. \\ \end{array}$$

4)50   0 cost of 4 cows

12 10 cost of 1 cow

7

5)87 10 value of 7 cows or 5 horses

17 10 value of 1 horse

8

£140   0 value of 8 horses

(4)...

$$\frac{\overset{95}{\cancel{475}} \times \overset{7}{\cancel{273}}}{\underset{39}{\cancel{195}}} = 665 \text{ yards}$$

(5)...

$$\cdot 09375 \quad : \quad \cdot 425 \quad :: \quad 826\cdot 875 \quad : \quad x$$

$$x = \frac{\cdot 425 \times \overset{8820}{\cancel{826\cdot 875}}}{\cancel{\cdot 09375}} = \pounds 3748\cdot 5 = \pounds 3748 \ 10s.$$

(6)...

$$\begin{array}{ccccccc} \text{yds.} & & \text{yds.} & & \text{yds.} & & \pounds \ s. \ d. & & \pounds \\ 7\tfrac{7}{8} & : & 19\cdot 2375 & = & 19\tfrac{19}{80} & : & 3 \ 18 \ 9 = 3\tfrac{15}{16} & : & x \end{array}$$

$$x = \frac{\cancel{8}}{\cancel{63}} \times \frac{1539}{\underset{10}{\cancel{80}}} \times \frac{\cancel{63}}{16} = \pounds \frac{1539}{160} = \pounds 9 \ 12s. \ 4\tfrac{1}{2}d.$$

(7)...

From May 1st to Dec. 6th = 219 days

$$\begin{array}{ccccccc} \pounds & \text{da.} & & \pounds & \text{da.} & & \pounds \ s. \ d. \\ 125 \times 365 & : & & 550 \times 219 & :: & 5 \ 12 \ 6 & : \quad x \end{array}$$

20

112

12

1350

$$x = \frac{\overset{22}{\cancel{550}} \times \overset{3}{\cancel{219}} \times \overset{\overset{54}{270}}{\cancel{1350}}}{\underset{5}{\cancel{125}} \times \underset{5}{\cancel{365}}} = 3564d. = \pounds 14 \ 17s.$$

(8)...

$$\overset{\pounds}{3\tfrac{1}{2}} \; : \; \overset{\pounds}{150} \; :: \; \overset{\pounds}{73\tfrac{1}{2}} \; : \; \text{required sum}$$

$$\text{required sum} = \frac{2}{7} \times \frac{150}{1} \times \frac{\overset{21}{\cancel{147}}}{\cancel{2}} = \pounds 3150$$

(9)...

$$11 \; : \; 15 = \tfrac{11}{15}; \quad 3\tfrac{5}{8} \; : \; 4\tfrac{3}{16} = \frac{3\tfrac{5}{8}}{4\tfrac{3}{16}} = \frac{58}{77};$$

$$2\cdot 75 \; : \; 3\cdot 85 = \frac{2\cdot 75}{3\cdot 85} = \frac{5}{7}$$

$$\tfrac{11}{15}, \; \tfrac{58}{77}, \; \tfrac{5}{7} = \tfrac{847}{1155}, \; \tfrac{870}{1155}, \; \tfrac{825}{1155}$$

$\therefore$ the ratio of $3\tfrac{5}{8} \; : \; 4\tfrac{3}{16}$, to which $\tfrac{870}{1155}$ corresponds,
is the greatest

(10)...

$$7 \; : \; 9 = \tfrac{7}{9}; \quad 15 \; : \; 21 = \tfrac{15}{21} = \tfrac{5}{7}$$

$$\frac{7}{9} \times \frac{5}{7} = \frac{5}{9} = 5 \; : \; 9;$$

$$5 \; : \; 8 = \tfrac{5}{8}; \quad 8 \; : \; 15 = \tfrac{8}{15}; \quad 15 \; : \; 32 = \tfrac{15}{32}$$

$$\frac{5}{\cancel{8}} \times \frac{\cancel{8}}{\cancel{15}} \times \frac{\cancel{15}}{32} = \frac{5}{32} = 5 \; : \; 32$$

Ans. 5 : 9; and 5 : 32

EXERCISE CII.

(1)...

	£	s.
3 cows at £10 15s. each =	32	5
18 sheep at 36s. each =	32	8
sum received =	£64	13

	£	s.	d.
Grocer's Bill	13	14	6
7½ yds. Cloth at 10s. 6d. =	3	18	9
18½ „ Merino at 2s. 3d. =	2	1	7½
2 prs. Blankets at 13s. 6d. =	1	7	0
sum paid =	£21	1	10½

$\therefore$ *he took home* £64 13s.—£21 1s. 10½d. = £43 11s. 1½d.

(2)...

			s.	d.		£	s.	d.
$1\frac{7}{8}$ yds.	Black Cloth	....	18	6	=	1	14	$8\frac{1}{4}$
$2\frac{1}{4}$ „	do. do.	....	14	6	=	1	12	$7\frac{1}{2}$
$2\frac{1}{2}$ „	Doeskin	....	6	9	=	0	16	$10\frac{1}{2}$
$18\frac{3}{4}$ „	Welsh Flannel	......	1	10	=	1	14	$4\frac{1}{2}$
1 Silk Umbrella		....				0	15	6
1 Alpaca do.		....				0	8	6
						£7	2	$6\frac{3}{4}$

(3)...

$$\frac{4\frac{3}{5}}{5\frac{1}{4}} + \frac{3\frac{3}{7}}{6\frac{2}{9}} + \frac{2\frac{4}{5}}{10\frac{1}{2}} = \frac{8}{9} + \frac{27}{49} + \frac{4}{15}$$

$$= \frac{1960 + 1215 + 588}{2205}$$

$$= \frac{3763}{2205} = 1\frac{1558}{2205}$$

(4)...

$$\frac{5}{8} \text{ of an acre} = 3025 \text{ square yards}$$

$$40 \left\{ \begin{array}{l} 5)3025 \\ \overline{8)605} \end{array} \right.$$

length = 75 yds. 1 ft. $10\frac{1}{2}$ in.

(5)...

fur.	mi.
·3125 = $68\frac{3}{4}$ yds.	·1625 = 286 yds.
220	1760
62500	97500
6250	11375
68·7500 yds.	1625
	286·0000 yds.

286 yds. — $68\frac{3}{4}$ yds. = $217\frac{1}{4}$ yds.

$$\frac{4)\,3}{40)23\cdot75}$$
$$4)\,1\cdot59375$$

1 ro. $23\frac{3}{4}$ per. = ·3984375 of an acre

(6)... $\cdot 66$ &c. $= \dfrac{6}{9} = \dfrac{2}{3}$; 533 &c. $= \dfrac{53-5}{90} = \dfrac{48}{90} = \dfrac{8}{15}$;

$\cdot 73232$ &c. $= \dfrac{732-7}{990} = \dfrac{725}{990} = \dfrac{145}{198}$;

$\cdot 27345345$ &c. $= \dfrac{27345-27}{99900} = \dfrac{27318 \cdot}{99900} = \dfrac{4553}{16650}$

(7)...
```
13)9·0(·692307        21)17·0(·809523
   78                    168
  ───                   ───
   120                   200
   117                   189
   ───                   ───
    30                    110
    26                    105
    ──                    ───
    40                     50
    39                     42
    ───                    ──
    100                    80
     91                    63
    ───                    ──
      9                    17
```

(8)...   16 for a shilling $= \frac{3}{4}d.$ each $= 9d.$ per dozen

cost $= 7\frac{1}{2}d.$,,

profit $= 1\frac{1}{2}d.$,,

$\overset{d.}{7\tfrac{1}{2}}$: $\overset{d.}{1\tfrac{1}{2}}$ :: 100 : 20 per cent. gain

(9)... $\frac{5}{7} = \cdot 714285714285(\cdot 845154 \ldots$
```
       64
  164)  742
       656
  1685)  8685
        8425
  16901)  26071
         16901
  169025)  917042
          845125
  1690304)  7191785
           6761216
           ───────
            430569
```

(10)...

$$377933067(723$$
$$343$$
$$7^2 \times 300 = 14700) \overline{34933}$$
$$29400 = 14700 \times 2$$
$$840 = 7 \times 30 \times 2^2$$
$$8 = 2^3$$
$$\overline{30248} \text{ subtrahend}$$
$$72^2 \times 300 = 1555200) \overline{4685067}$$
$$4665600 = 1555200 \times 3$$
$$19440 = 72 \times 30 \times 3^2$$
$$27 = 3^3$$
$$\overline{4685067}$$

EXERCISE CIII.

(1)...

$$5^5 = 5 \times 5 \times 5 \times 5 \times 5 = 3125$$
$$6^6 = 6 \times 6 \times 6 \times 6 \times 6 \times 6 = 46656$$
$$7^7 = 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 = 823543$$
$$8^8 = 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 = 16777216$$
$$9^9 = 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 = 387420489$$

(2)...1.

		£	s.	d.
$3s.\ 4d. = \frac{1}{6}$ of £1		2372	0	0 = value at £1 per yd.
$\frac{1}{2}d. = \frac{1}{80}$ of $3s.\ 4d.$		395	6	8
$\frac{1}{4}d. = \frac{1}{2}$ of $\frac{1}{2}d.$		4	18	10
		2	9	5
		£402	14	11

2.

		£	s.	d.
$5s.\ 0d. = \frac{1}{4}$ of £1		4263	0	0 = value at £1 per oz.
$1s.\ 8d. = \frac{1}{3}$ of $5s.$		1065	15	0
$2\frac{1}{2}d. = \frac{1}{8}$ of $1s.\ 8d.$		355	5	0
		44	8	$1\frac{1}{2}$
		£1465	8	$1\frac{1}{2}$

3.

		£	s.	d.
$2s.\ 6d. = \frac{1}{8}$ of £1		967	0	0 = value at £1 per cwt.
$2\frac{1}{2}d. = \frac{1}{12}$ of $2s.\ 6d.$		120	17	6
		10	1	$5\frac{1}{2}$
		£1097	18	$11\frac{1}{2}$

(3)...

$$\begin{array}{ccccccc} \text{hrs. min.} & & \text{mi.} & & \text{hr.} & & \text{mi.} \\ 4\ 32 & = & 4\tfrac{8}{15} & : & 1 & :: & 17 & : & x \end{array}$$

$$x = \frac{15}{\cancel{68}\,4} \times \frac{\cancel{17}}{1} = \frac{15}{4} \text{ mi.} = 3\tfrac{3}{4} \text{ miles}$$

(4)...10 acres 3 roods 39 perches $25\tfrac{1}{4}$ sq. yds.$=$53235 sq. yds.

$$53235 \div 42\tfrac{1}{4} = 1260, \text{ No. of trees}$$

(5)...

$$\begin{array}{cc} \text{sq. ft.} & \text{ft.} \\ 446\tfrac{1}{3} \div 25\tfrac{3}{4} \end{array} = \frac{\overset{13}{\cancel{1339}}}{3} \times \frac{4}{\cancel{103}} = \frac{52}{3} = 17\tfrac{1}{3} \text{ feet}$$

(6)...

$$\begin{array}{ccccccc} \text{wo. da. hrs.} & & \text{wo. da. hrs.} & & s. & & s. \\ 5 \times 6 \times 10 & : & 6 \times 15 \times x & :: & 20 & : & 72 \end{array}$$

$$x = \frac{\cancel{5} \times \cancel{6} \times \cancel{10} \times \overset{\overset{12}{\cancel{24}}}{\cancel{72}}}{\underset{\underset{3}{\cancel{6}} \times \cancel{15} \times \underset{2}{\cancel{20}}}} = 12 \text{ hours}$$

(7)... 17·45 Eng. ells $= 21·8125$ yds. $= 21\tfrac{13}{16}$ yds.

$$\begin{array}{ccccccc} \text{yd.} & & \text{yds.} & & £ & & \\ 1 & : & 21\tfrac{13}{16} & :: & \tfrac{7}{30} & : & x \end{array}$$

$$x = \tfrac{349}{16} \times \tfrac{7}{30} = £\tfrac{2443}{480} = £5 \text{ 1s. } 9\tfrac{1}{2}d.$$

(8)... 4 per cent. $= \tfrac{1}{25}$ of 100

$\tfrac{1}{2}$,, ,, $= \tfrac{1}{8}$ of 4

$$\begin{array}{rrr} £ & s. & d. \\ \overline{647} & 10 & 0 \\ \hline 25 & 18 & 0 \\ 3 & 4 & 9 \\ \hline 29 & 2 & 9 \text{ int. for 1 year} \\ & & 3\tfrac{3}{4} \\ \hline 87 & 8 & 3 \end{array}$$

$$\begin{array}{rrrr} \tfrac{1}{2} \text{ year} = & 14 & 11 & 4\tfrac{1}{2} \\ \tfrac{1}{4} \text{ year} = & 7 & 5 & 8\tfrac{1}{4} \\ \hline £109 & 5 & 3\tfrac{3}{4} \text{ int. for } 3\tfrac{3}{4} \text{ years} \end{array}$$

(9)... Int. for 1 year = £74 16s. 3d. ÷ 4½ = £16 12s. 6d.

$$
\begin{array}{ccccccc}
\pounds & & \pounds & & \pounds & s. & d. \\
\cancel{475} & : & \cancel{100} & :: & 16 & 12 & 6 \\
19 & & 4 & & & & 4 \\
\end{array}
$$

$$19)\overline{66\ 10\ 0}$$

$$\pounds 3\ 10\ 0 = 3\tfrac{1}{2} \text{ per cent.}$$

(10)...   Amount of £100 in 4¾ years at 5 per cent.

$$= \pounds 100 + (\pounds 5 \times 4\tfrac{3}{4}) = \pounds 123\ 15s.$$

$$
\begin{array}{ccccccc}
\pounds & s. & & \pounds & s. & d. & & \pounds \\
123 & 15 & : & 276 & 19 & 10\tfrac{1}{2} & :: & 100 \\
20 & & & & 8 \times 10 & = 80 & & 20 \\
\end{array}
$$

$$
\begin{array}{ccc}
\cancel{2475} & 2215\ 19\ 0 & \cancel{2000} \\
99 & 10 & 80 \\
\end{array}
$$

$$99 \left\{ \begin{array}{l} 11)\overline{22159\ 10\ 0} \\ 9)\overline{2014\ 10\ 0} \end{array} \right.$$

$$\pounds 223\ 16\ 8$$

EXERCISE CIV.

(1)...
$$
\begin{array}{lllrcrrr}
 & & & s. & d. & \pounds & s. & d. \\
75\tfrac{1}{2} \text{ yds.} & \text{Calico} & & & 9\tfrac{1}{2} & = 2 & 19 & 9\tfrac{1}{4} \\
52\tfrac{1}{4} \text{ ,,} & \text{Brown Holland} & & & 11\tfrac{1}{2} & = 2 & 10 & 3\tfrac{3}{8} \\
78\tfrac{1}{2} \text{ ,,} & \text{Irish Linen} & 1 & & 8\tfrac{1}{2} & = 6 & 14 & 1\tfrac{1}{4} \\
49 \text{ ,,} & \text{Welsh Flannel} & 1 & & 5\tfrac{1}{2} & = 3 & 11 & 5\tfrac{1}{2} \\
26\tfrac{3}{4} \text{ ,,} & \text{Drugget} & 2 & & 9 & = 3 & 13 & 6\tfrac{1}{4} \\
\end{array}
$$

$$\pounds 19\ 9\ 2\tfrac{1}{2}$$

(2)...   2 qrs. 19½ lb. × 13 = 981½ lb.

$$
\begin{array}{ccccccc}
\text{lb.} & & \text{lb.} & & \pounds & s. & d. \\
53\tfrac{1}{2} & : & 981\tfrac{1}{2} & :: & 1 & 8 & 11\tfrac{3}{4} & : & x \\
2 & & 2 & & 20 & & \\
\hline
107 & & 1963 & & 28 & & \\
& & & & 12 & & \\
\hline
& & & & 347 & & \\
& & & & 4 & & \\
\hline
& & & & 1391 & & \\
\end{array}
$$

$$x = \frac{1963 \times \overset{13}{\cancel{1391}}}{\cancel{107}} = 25519 \text{ far.} = \pounds 26\ 11s.\ 7\tfrac{3}{4}d.$$

<div style="text-align:center">

£   s.   d.

</div>

(3)...

$$1 \quad 14 \quad 8 \text{ per acre}$$

$$4 \times 6 \times 10 + 8 = 248$$

$$\overline{6 \quad 18 \quad 8}$$

$$6$$

$$\overline{41 \quad 12 \quad 0}$$

$$10$$

$$\overline{416 \quad 0 \quad 0}$$

$$13 \quad 17 \quad 4$$

			£	s.	d.
2 ro.	= ½ acre......	=		17	4
10 per.	= ⅕ of 2 ro.	=		2	2
5 per.	= ½ of 10 per.	=		1	1
2½ per.	= ½ of 5 per.	=			6½
			£430	18	5½

(4)...1. $\left(3\frac{5}{7}+2\frac{5}{6}+3\frac{3}{10}\right)-\left(2\frac{9}{14}+1\frac{7}{12}+2\frac{13}{20}\right)$

$= \left(3\frac{150}{210}+2\frac{175}{210}+3\frac{63}{210}\right)-\left(2\frac{270}{420}+1\frac{245}{420}+2\frac{273}{420}\right)$

$= 9\frac{88}{105}-6\frac{92}{105}$

$= 2\frac{102}{105} = 2\frac{34}{35}$

2. $\left(4\frac{1}{2}\times 6\frac{2}{3}\times 3\frac{3}{8}\right)\div\left(5\frac{2}{5}\times 1\frac{2}{3}\times 2\frac{2}{7}\right)$

$= \dfrac{9}{2}\times\dfrac{\overset{5}{\cancel{20}}}{\cancel{3}}\times\dfrac{\cancel{27}}{\underset{2}{\cancel{8}}}\times\dfrac{5}{\cancel{27}}\times\dfrac{3}{\cancel{5}}\times\dfrac{7}{16}$

$= \frac{315}{64} = 4\frac{59}{64}$

3. $(7{\cdot}265-4{\cdot}937)\times(6{\cdot}58+9{\cdot}675)$

$= 2{\cdot}328\times16{\cdot}255$

$= 37{\cdot}84164$

(5)...

$$\frac{11}{18}\text{ hf. gui.} = \frac{11}{\cancel{18}_{6}} \times \frac{\cancel{21}^{7}}{2} = \frac{77}{12} = \overset{s.}{6} \quad \overset{d.}{5}$$

$$\left(\frac{3}{5} \text{ of } \frac{7}{12}\right)\text{ hf. cr.} = \frac{7}{\cancel{20}_{4}} \times \frac{\cancel{5}}{2} = \frac{7}{8} = \quad \frac{10\frac{1}{2}}{5 \quad 6\frac{1}{2}}$$

$$\begin{array}{l} 4)\overline{2} \\ 12)\overline{6\cdot5} \\ 20)\overline{5\cdot5416} \end{array}$$

$$5s.\ 6\tfrac{1}{2}d. = \overline{\cdot277083}\text{ of a sov.}$$

(6)..."Discounting" a bill is giving cash for it, deducting a sum proportionate to the amount of the bill and the time it has to run. It is the invariable practice of bankers and bill-discounters to deduct *interest* instead of *discount*, thus charging for the transaction a sum exceeding the true discount by the interest upon the true discount for the given time. An illustration will make this clearer: If a bill for £410 be discounted at 5 per cent. when it has six months to run, the banker would deduct £10 5s. as *discount*, whereas the true discount is only £10. The difference, 5s., is the interest upon £10 for six months. The banker, in fact, has obtained interest on £410, whereas he has lent only £399 15s.: the latter sum, if put out to interest, would amount to £409 14s. 10½d. in six months, not to £410.

Amount of £100 in 4 months at 5 per cent. per annum
$$= £100 + (£5 \times \tfrac{1}{3}) = £101\ 13s.\ 4d.$$

£	s.	d.		£		£	s.	d.		
101	13	4	:	150	::	1	13	4	:	required discount
3						3				
305						5				

$$\text{required discount} = \frac{150 \times \cancel{5}}{\cancel{305}_{61}} = £\frac{150}{61} = £2\ 9s.\ 2\tfrac{10}{61}d.$$

Banker's discount, or interest = £150+20+3

               = £2 10s. 0d.

    True discount = £2   9s. $2\frac{10}{61}d$.

    Amount of error = $9\frac{51}{61}d$.

This sum of $9\frac{51}{61}d$. is the interest of £2 9s. $2\frac{10}{61}d$. for 4 months, at 5 per cent. per annum.

(7)...   From March 17 to October 22 = 219 days

    Int. on £225 12s. 6d. for 1 year = £12 15s. $7\frac{1}{2}d$.

da.		da.		£	s.	d.
3̶6̶5̶	:	2̶1̶9̶	::	12	15	7½
5		3				3

                     5)38   6   10½

                     £7   13   4½

(8)...Amount of £100 in 9 months, at $4\frac{1}{2}$ per cent. per annum

       = £100 + (£4 10s. × $\frac{3}{4}$) = £103 7s. 6d.

£	s.	d.		£	s.		£	
103	7	6	:	157	10	::	100	: present worth
8				8				
827				1260				

present worth = $\dfrac{1260 \times 100}{827}$ = £$\dfrac{126000}{827}$ = £152 7s. $1\frac{445}{827}d$.

(9)...   A. 5 oxen × 8 mo. = 40

               B. 7 ,, × 5 ,, = 35

               C. 5 ,, ×10 ,, = 50

                          125

                            £   £

   125   :   40   ::   25   :   8, A's portion

                            £   £

   125   :   35   ::   25   :   7, B's portion

                            £   £

   125   :   50   ::   25   :   10, C's portion

(10)... $\qquad \sqrt{7\frac{1}{9}} = \sqrt{\frac{64}{9}} = \frac{8}{3} = 2\frac{2}{3}$

$\sqrt[3]{166\frac{3}{8}} = \sqrt[3]{\frac{1331}{8}} = \frac{11}{2} = 5\frac{1}{2}$

EXERCISE CV.

(1)... See "*Answers.*"

(2)... See "*Answers.*"

(3)...

$15 \begin{cases} 5)7 \\ 3)\overline{1\cdot4} \\ \hline \cdot466 \ \&c. \end{cases}$
$\qquad$
$16 \begin{cases} 4)11 \\ 4)\overline{\ 2\cdot75} \\ \hline \cdot6875 \end{cases}$

$25 \begin{cases} 5)19 \\ 5)\overline{\ 3\cdot8} \\ \hline \cdot76 \end{cases}$
$\qquad$
$30 \begin{cases} 5)17 \\ 6)\overline{\ 3\cdot4} \\ \hline \cdot566 \ \&c. \end{cases}$

$50 \begin{cases} 5)27 \\ 10)\overline{\ 5\cdot4} \\ \hline \cdot54 \end{cases}$
$\qquad$
$64 \begin{cases} 8)25 \\ 8)\overline{\ 3\cdot125} \\ \hline \cdot390625 \end{cases}$

(4)...

$$3\frac{1}{2} \ : \ 15\frac{3}{4} \ :: \ 1\frac{5}{8} \ : \ x$$

$$x = \frac{\overset{1}{\cancel{2}}}{7} \times \frac{\overset{9}{\cancel{63}}}{\underset{2}{\cancel{4}}} \times \frac{13}{8} = \frac{117}{16} = 7\frac{5}{16}$$

$$1\frac{2}{9} \ : \ x \ :: \ x \ : \ 2\frac{3}{4}$$

$$x^2 = 1\frac{2}{9} \times 2\frac{3}{4}$$
$$= \frac{11}{9} \times \frac{11}{4}$$
$$= \frac{121}{36}$$
$$\therefore \ x = \frac{11}{6} = 1\frac{5}{6}$$

(5)...

2 qrs. $17\frac{1}{2}$ lb. $= 147$ half-pounds
1 cwt. $= 224$ „

$\frac{147}{224} \div \frac{7}{7} = \frac{21}{32}$ of a cwt.

R

(6)... $\frac{19}{40} = \cdot 475$ $\cdot 725 = \frac{725}{1000} = \frac{29}{40}$

$\frac{19}{32} = \cdot 59375$ $\cdot 305 = \frac{305}{1000} = \frac{61}{200}$

$$\frac{19}{40} + \frac{29}{40} + \frac{19}{32} + \frac{61}{200} = \frac{380 + 580 + 475 + 244}{800}$$

$$= \frac{1679}{800} = 2\frac{79}{800}$$

$\cdot 475$
$\cdot 725$
$\cdot 59375$
$\cdot 305$
$\overline{2\cdot 09875}$

(7)...

gui.
$\cdot 6875 = 14s.\ 5\frac{1}{4}d.$ $\cdot 8125 = 16s.\ 3d.$

21 20
$\overline{14\cdot 4375s.}$ $\overline{16\cdot 2500s.}$
12 12
$\overline{5\cdot 2500d.}$ $\overline{3\cdot 0000d.}$
4
$\overline{1\cdot 0000\ \text{far.}}$

	s.	d.
	16	3
	14	$5\frac{1}{4}$
	1s.	$9\frac{3}{4}d.$

(8)... $\cdot 4666\ \&c. = \dfrac{46-4}{90} = \dfrac{42}{90} = \dfrac{7}{15}$

$$\frac{7}{15}\ \text{sov.} = \frac{7}{\cancel{15}_3} \times \frac{\cancel{20}^4}{1} = \frac{28}{3} = 9s.\ 4d.$$

(9)...

lb.   lb.   s. d.   £
$3\frac{9}{10}$: $17\frac{7}{8}$ ::   16 3 $= \frac{13}{16}$: x

$$x = \frac{\cancel{10}^5}{\cancel{39}_3} \times \frac{143}{\cancel{8}_4} \times \frac{\cancel{13}}{16} = £\frac{715}{192} = £3\ 14s.\ 5\frac{3}{4}d.$$

(10)...
$$\text{A can do } 2\tfrac{2}{3} \text{ yards in 1 day}$$
$$\text{B } ,, \quad 2\tfrac{2}{5} \quad ,, \quad ,,$$

∴ A and B together can do $2\tfrac{2}{3} + 2\tfrac{2}{5} = 5\tfrac{1}{15}$ yards in 1 day

$$114 \div 5\tfrac{1}{15} = \frac{\overset{3}{\cancel{114}}}{1} \times \frac{15}{\underset{2}{\cancel{76}}} = \frac{45}{2} = 22\tfrac{1}{2} \text{ days}$$

EXERCISE CVI.

(1)...

ac.	ro.	po.	yds.
5	2	22	25¼
7	3	15	18½
11	1	35	26¼
24	3	34	9½

$$\begin{array}{r} 4 \\ \hline 99 \\ 40 \\ \hline 3994 \\ 30\tfrac{1}{4} \\ \hline 119829\tfrac{1}{2} \\ 998\tfrac{1}{2} \\ \hline 120828 \text{ square yards} \end{array}$$

(2)...1 cwt. 1 qr. 16½ lb. = 156½ lb. £6 16s. 11¼d. = 6573 far.

$$\begin{array}{ccccc} \text{lb.} & & \text{lb.} & & \text{far.} \\ 156\tfrac{1}{2} & : & 1 & :: & 6573 & : & x \\ 2 & & 2 & & \\ \hline 313 & & 2 & & \end{array}$$

$$x = \frac{2 \times \overset{21}{\cancel{6573}}}{\cancel{313}} = 42 \text{ far.} = 10\tfrac{1}{2}d. \text{ per lb.}$$

R 2

ft.

(3) ...
$$13800$$
$$4$$

$$9\overline{)55200} \text{ sq. ft.}$$

$$6133\tfrac{1}{3} \text{ sq. yds.}$$
$$4$$

$$\begin{array}{c}\text{yds.} \\ 30\tfrac{1}{4}\end{array} = \begin{array}{c}\text{qrs.} \\ 121\end{array} \left\{ \begin{array}{l} 11\overline{)245333\tfrac{1}{3}} \\ 11\overline{)\ \ 2230\ \ 3\tfrac{1}{3}} \\ 40\overline{)\ \ \ 202\ \ 8} \\ \ 4\overline{)\ \ \ \ \ 5\ \ 2} \text{ po.} \\ \ \ \ \ \ \ 1\ \ 1 \text{ ro.} \end{array} \right\} = \begin{array}{c}\text{qr. yds.} \\ 91\tfrac{1}{3}\end{array} = \begin{array}{cc}\text{sq. yds.} & \text{sq. ft.} \\ 22 & 7\tfrac{1}{2}\end{array}$$

Ans. 1 ac. 1 ro. 2 po. 22 sq. yds. 7½ sq. ft.

(4)...
$$\begin{array}{c}\text{yds.} \\ 29\tfrac{5}{8}\end{array} : \begin{array}{c}\text{yds.} \\ 37\tfrac{3}{8}\end{array} : \begin{array}{ccc}£ & s. & d. \\ 15 & 11 & 0\tfrac{3}{4}\end{array} = 15\tfrac{177}{320} : \begin{array}{c}£ \\ x\end{array}$$

$$x = \frac{8}{237} \times \frac{299}{8} \times \frac{4977\,^{21}}{320\,_{40}} = £\frac{6279}{320} = £19 \ 12s. \ 5\tfrac{1}{4}d.$$

(5)...
$$455725$$
$$192305$$
$$\overline{263420} \text{ increase in 50 years}$$

$$\begin{array}{ccc} 192305 & : \ 263420 \ :: & 100 \\ 38461 & 20 & 20 \end{array}$$

$$38461\overline{)5268400}(136\tfrac{37704}{38461} \text{ per cent.}$$
$$\underline{38461}$$
$$142230$$
$$\underline{115383}$$
$$268470$$
$$\underline{220766}$$
$$37704$$
$$\overline{38461}$$

	hrs. da.		hrs. da.		bu. pk.		

(6)...　　15×6　:　24×56　::　11　1　:　x

$$\frac{4}{45}$$

$$x = \frac{\overset{4}{\cancel{24}} \times 56 \times \overset{3}{\cancel{45}}}{\cancel{15} \times \cancel{6}} = 672 \text{ pecks} = 21 \text{ quarters}$$

(7)...　　　　　$1{\cdot}825$　:　$1{\cdot}331$　::　$\overset{oz.}{4{\cdot}5}$

$$4{\cdot}5$$
$$\overline{6655}$$
$$5324$$
$$1{\cdot}825)\overline{5{\cdot}9895}(3{\cdot}2819 \text{ ounces}$$
$$5475$$
$$\overline{5145}$$
$$3650$$
$$\overline{14950}$$
$$14600$$
$$\overline{3500}$$
$$1825$$
$$\overline{16750}$$
$$16425$$
$$\overline{325}$$

(8)...　　From May 13 to October 6 = 146 days

per cent.		£	s.	d.
5	$\frac{1}{20}$	752	1	8
$\frac{1}{4}$	$\frac{1}{20}$	37	12	1
		1	17	$7\frac{1}{4}$

£39　9　$8\frac{1}{4}$ int. for 1 year

da.		da.		£	s.	d.
$\cancel{365}$	:	$\cancel{146}$	::	39	9	$8\frac{1}{4}$
5		2				2

$$5)\overline{78 \quad 19 \quad 4\frac{1}{2}}$$
$$\overline{£15 \quad 15 \quad 10\frac{1}{2}}$$

(9)..

$$
\begin{array}{rrl}
£ & s. & d. \\
266 & 4 & 9 \text{ amount} \\
225 & 12 & 6 \text{ principal} \\
\hline
£40 & 12 & 3 \text{ interest}
\end{array}
$$

$$
\text{per cent.} \quad
\begin{array}{cl}
& £ \quad s. \quad d. \\
4 = \tfrac{1}{25}) & 225 \quad 12 \quad 6 \\
\hline
& £9 \quad 0 \quad 6 \text{ int. for 1 year}
\end{array}
$$

$$
\begin{array}{ccc}
£ \ s. \ d. & £ \ s. \ d. & \text{yr.} \quad \text{yrs.} \\
9 \ 0 \ 6 \quad : \quad 40 \ 12 \ 3 \quad :: \quad 1 \ : \ 4\tfrac{1}{2}
\end{array}
$$

(10)...
$$
\begin{array}{ccccc}
£ & & £ & & £ \\
77\tfrac{1}{2} & : & 2500 & :: & 3\tfrac{1}{2} & : & \text{required income} \\
2 & & & & 2 \\
\hline
155 & & & & 7
\end{array}
$$

$$
\text{required income} = \frac{\overset{500}{\cancel{2500}} \times 7}{\underset{31}{\cancel{155}}} = £\frac{3500}{31} = £112 \ 18s. \ 0\tfrac{24}{31}d.
$$

EXERCISE CVII.

(1)...
				s.	d.	£	s.	d.
15	doz.	Cotton Hose	....	17	6 =	13	2	6
18	„	Angola „	....	27	6 =	24	15	0
10	„	Lbswool „	....	25	6 =	12	15	0
12	„	Cotton Half-hose	......	13	6 =	8	2	0
9	„	Angola „	......	21	6 =	9	13	6
8	„	Kid Gloves	....	22	6 =	9	0	0
6	„	Norway Doe ditto.	...19	6 =		5	17	0
						£83	5	0

(2)...

$$\frac{11}{18}\text{ gui.} = \frac{11}{\cancel{18}_{6}} \times \frac{\cancel{21}^{7}}{1} = \frac{77}{6} = \quad \begin{matrix} s. & d. \\ 12 & 10 \end{matrix}$$

$$\frac{7}{15}\text{ sov.} = \frac{7}{\cancel{15}_{3}} \times \frac{\cancel{20}^{4}}{1} = \frac{28}{3} = \quad 9 \quad 4$$

$$\frac{11}{20}\text{ cr.} = \frac{11}{\cancel{20}_{4}} \times \frac{\cancel{5}}{1} = \frac{11}{4} = \quad 2 \quad 9$$

$$\frac{13}{16}\text{ fl.} = \frac{13}{\cancel{16}_{8}} \times \frac{\cancel{2}}{1} = \frac{13}{8} = \quad \underline{\quad 1 \quad 7\tfrac{1}{2}\quad}$$
$$\begin{matrix} £1 & 6 & 6\tfrac{1}{2} \end{matrix}$$

(3)...

4) 1	4) 1
12)11·25	12) 8·25
20)12·9375	21)19·6875
12s. 11¼d. = ·646875 of £1	19s. 8¼d. = ·9375 of a gui.

(4)... $\dfrac{13}{112}\text{ week} = \dfrac{13}{\cancel{112}_{16}} \times \dfrac{7}{1} = \dfrac{13}{16}\text{ day} = 19\text{ hrs. }30\text{ min.}$

$$\begin{array}{r}
\overset{\text{da.}}{·90625} = 21\text{ hrs. }45\text{ min.} \\
24 \\
\hline
362500 \\
181250 \\
\hline
21·75000\text{ hrs.} \\
60 \\
\hline
45·00000\text{ min.}
\end{array}$$

	hrs.	min.
	21	45
	19	30
hrs.	2	15 min.

$$(5)\ldots\quad \cdot 174242\ \&c. = \frac{1742-17}{9900} = \frac{1725}{9900} = \frac{23}{132},$$

$$\cdot 32957957\ \&c. = \frac{32957-32}{99900} = \frac{32925}{99900} = \frac{439}{1332}$$

$$(6)\ldots\overset{\text{hrs.}}{175}\times\overset{\text{da.}}{12}\ :\ \overset{\text{hrs.}}{300}\times\overset{\text{da.}}{x}\ ::\ \overset{\text{ft.}}{20}\times\overset{\text{ft.}}{15}\times\overset{\text{ft.}}{14}\ :\ \overset{\text{ft.}}{28}\times\overset{\text{ft.}}{25}\times\overset{\text{ft.}}{18}$$

$$x = \frac{175 \times 12 \times 28 \times 25 \times 18}{300 \times 20 \times 15 \times 14} = 21\ \text{days}$$

(7)...Amount of £100 in 8 mo. at $4\frac{1}{2}$ per cent. per annum
$$= £100 + (£4\tfrac{1}{2}\times\tfrac{2}{3}) = £103$$

$$\begin{array}{ccccc}
£ & & £\ \ s.\ \ d. & & £\\
103 & : & 113\ \ 17\ \ 6 & : & 100 & : & \text{present worth}\\
\underline{8} & & \underline{8} & &\\
824 & & 911 & &
\end{array}$$

$$\text{present worth} = \frac{911 \times 100}{824} = £\frac{22775}{206} = £110\ 11s.\ 1\tfrac{181}{103}d.$$

$$(8)\ldots\quad \begin{array}{ccccc}
£ & & £ & & £\\
89\tfrac{7}{8} & : & 1000 & :: & 100 & : & x\\
\underline{8} & & \underline{8} & &\\
719 & & 8000 & &
\end{array}$$

$$x = \frac{8000 \times 100}{719} = £\frac{800000}{719} = £1112\ 13s.\ 1\tfrac{397}{719}d.$$

(9)... $68\frac{3}{4}$ lb. tea at 3s. 10d. per lb. $=$

	£	s.	d.
	13	3	$6\frac{1}{2}$
cost price $=$	11	9	2
profit $= £1$	14	$4\frac{1}{2}$	

£	s.	d.		£	s.	d.			
11	9	2	:	1	14	$4\frac{1}{2}$	::	100	: 15 per cent.

(10)...

	£	s.	d.
A's debt $=$	265	10	0
B's ,, $=$	372	15	0
C's ,, $=$	438	12	6
	£1076	17	6

£	s.		£	s.	d.		s.	
265	10	:	.179	4	3	::	20	: x
20			20					
5310			3584					
			12					
			43011					

$$x = \frac{\overset{81}{\cancel{43011}} \times \overset{2}{\cancel{20}}}{\underset{\cancel{10}}{\cancel{5310}}} = 162d. = 13s.\ 6d.\ \text{in the pound}$$

s.	d.			£	s.	d.
10	0	$= \frac{1}{2}$ of £1		372	15	0
2	6	$= \frac{1}{4}$ of 10s.		186	7	6
1	0	$= \frac{1}{10}$ of 10s.		46	11	$10\frac{1}{2}$
				18	12	9
		B's portion £251			12	$1\frac{1}{2}$

s.	d.			£	s.	d.
10	0	$= \frac{1}{2}$ of £1		438	12	6
2	6	$= \frac{1}{4}$ of 10s.		219	6	3
1	0	$= \frac{1}{10}$ of 10s.		54	16	$6\frac{3}{4}$
				21	18	$7\frac{1}{2}$
		C's portion £296			1	$5\frac{1}{4}$

EXERCISE CVIII

(1)...

$$16 \begin{cases} 4)\underline{11} \\ 4)\ \overline{2\cdot75} \end{cases}$$
$$\overline{\cdot6875}$$

$$40 \begin{cases} 5)\underline{23} \\ 8)\ \overline{4\cdot6} \end{cases}$$
$$\overline{\cdot575}$$

$$18 \begin{cases} 2)\underline{13} \\ 9)\ \overline{6\cdot5} \end{cases}$$
$$\overline{\cdot7\dot{2}}$$

$$25 \begin{cases} 5)\underline{17} \\ 5)\ \overline{3\cdot4} \end{cases}$$
$$\overline{\cdot68}$$

$$30 \begin{cases} 5)\underline{19} \\ 6)\ \overline{3\cdot8} \end{cases}$$
$$\overline{\cdot6\dot{3}}$$

$$48 \begin{cases} 8)\underline{25} \\ 6)\ \overline{3\cdot125} \end{cases}$$
$$\overline{\cdot5208\dot{3}}$$

(2)...

$$\cdot275 = \tfrac{275}{1000} = \tfrac{11}{40}, \quad \cdot3125 = \tfrac{3125}{10000} = \tfrac{5}{16},$$

$$\cdot0625 = \tfrac{625}{10000} = \tfrac{1}{16}, \quad \cdot4875 = \tfrac{4875}{10000} = \tfrac{39}{80}$$

(3)...

$$\cdot755 = \tfrac{755}{1000} = \tfrac{151}{200}, \quad 9\cdot105 = 9\tfrac{105}{1000} = 9\tfrac{21}{200},$$

$$25 \begin{cases} 5)\underline{13} \\ 5)\ \overline{2\cdot6} \end{cases}$$
$$\tfrac{13}{25} = \ \overline{\cdot52}$$

$$32 \begin{cases} 4)\underline{19} \\ 8)\ \overline{4\cdot75} \end{cases}$$
$$\tfrac{19}{32} = \ \overline{\cdot59375}$$

$$\frac{151}{200} + \frac{13}{25} + 9\tfrac{21}{200} + \frac{19}{32} = 9 + \frac{604+416+84+475}{800}$$

$$= 9 + \tfrac{1579}{800}$$

$$= 9 + 1\tfrac{779}{800} = 10\tfrac{779}{800}$$

$$\begin{array}{r} \cdot755 \\ \cdot52 \\ 9\cdot105 \\ \underline{\cdot59375} \\ \overline{10\cdot97375} \end{array}$$

(4)... $27\frac{7}{8} = 27 \cdot 875$

$24 \cdot 0125$

$19 \cdot 2375$ $\qquad 15\frac{13}{20} = 15 \cdot 65$

$\overline{8 \cdot 6375} = 8\frac{51}{80}$ $\overline{8 \cdot 3625} = 8\frac{29}{80}$

(5)...

1. $19 \cdot 425 - 26 \cdot 05 + 57 \cdot 0785 - 30 \cdot 515 = 19 \cdot 9385$

2. $(46 \cdot 05 - 17 \cdot 375 - 15 \cdot 8625) \times 8 \cdot 57$

$= 12 \cdot 8125 \times 8 \cdot 57$

$= 109 \cdot 803125$

(6)...

$$
\begin{array}{r}
8 \cdot 375 \\
27 \cdot 6 \\
\hline
50250 \\
58625 \\
16750 \\
\hline
231 \cdot 1500
\end{array}
$$

$$
\begin{array}{r}
\cdot 5625 \\
\cdot 1075 \\
\hline
28125 \\
39375 \\
56250 \\
\hline
\cdot 06046875
\end{array}
$$

(7)...

$$
\begin{array}{r}
9 \cdot 63)521 \cdot 22375(54 \cdot 125 \\
4815 \\
\hline
3972 \\
3852 \\
\hline
1203 \\
963 \\
\hline
2407 \\
1926 \\
\hline
4815 \\
4815 \\
\hline
\end{array}
$$

$$
\begin{array}{r}
76 \cdot 35) \cdot 3550275(\cdot 00465 \\
30540 \\
\hline
49627 \\
45810 \\
\hline
38175 \\
38175 \\
\hline
\end{array}
$$

(8)...

$$
\begin{array}{r}
357 \cdot 436)29 \cdot 3675000(\cdot 0821 \ldots \ldots \\
2859488 \\
\hline
772620 \\
714872 \\
\hline
577480 \\
357436 \\
\hline
220044
\end{array}
$$

(9)...

$$113\tfrac{47}{64} = 113{\cdot}734375$$

$$
\begin{array}{r}
113{\cdot}734375 \\
532{\cdot}048 \\
\hline
909875000 \\
454937500 \\
2274687500 \\
341203125 \\
568671875 \\
\hline
60512{\cdot}146750000 = 60512\tfrac{587}{4000}
\end{array}
$$

$$207\tfrac{53}{160} = 207{\cdot}33125$$

$$
\begin{array}{r}
207{\cdot}33125 \\
59{\cdot}436 \\
\hline
124398750 \\
62199375 \\
82932500 \\
186598125 \\
103665625 \\
\hline
12322{\cdot}94017500 = 12322\tfrac{37807}{40000}
\end{array}
$$

(10)...

$$505{\cdot}582 \div 471\tfrac{5}{8} = 505\tfrac{291}{500} \div 471\tfrac{5}{8}$$

$$= \frac{\overset{67}{\cancel{252791}}}{\underset{125}{\cancel{500}}} \times \frac{\overset{2}{\cancel{8}}}{\cancel{3773}}$$

$$= \tfrac{134}{125} = 1\tfrac{9}{125}$$

$$471\tfrac{5}{8} = 471{\cdot}625 \overline{)505{\cdot}582000}(1{\cdot}072$$

$$
\begin{array}{r}
471625 \\
\hline
3395700 \\
3301375 \\
\hline
943250 \\
943250 \\
\hline
\end{array}
$$

$$764\tfrac{63}{250} = 764{\cdot}252 \overline{)2426{\cdot}500100}(3{\cdot}175$$

$$
\begin{array}{r}
2292756 \\
\hline
1337441 \\
764252 \\
\hline
5731890 \\
5349764 \\
\hline
3821260 \\
3821260 \\
\hline
\end{array}
$$

$$3{\cdot}175 = 3\tfrac{175}{1000} = 3\tfrac{7}{40}$$

EXERCISE CIX.

(1)...

$$4)\ 3$$
$$12)\ \overline{3\cdot75}$$
$$20)\overline{13\cdot3125}$$

13s. 3¾d. = ‾‾‾·665625 of a sov.

$$4)1$$
$$12)\overline{2\cdot25}$$
$$21)\overline{9\cdot1875}$$

9s. 2¼d. = ·4375 of a gui.

(2)...

sov.	s.	d.
·484375 =	9	8¼

20

9·687500s

12

8·250000d.

4

1·000000 far.

gui.	s.	d.
·6875 =	14	5¼

21

14·4375s.

12

5·2500d.

4

1·0000 far.

s.	d.
9	8¼
14	5¼
£1 4	1½

(3)...

$$\frac{19}{28}\ \text{gui.} = \frac{19}{\underset{4}{\cancel{28}}} \times \frac{\overset{3}{\cancel{21}}}{1} = \frac{57}{4} = 14\ \overset{s.}{}\ \overset{d.}{3}$$

sov.	s.	d.
·953125 =	19	0¾

20

19·062500s.

12

0·750000d.

4

3·000000 far.

s.	d.
19	0¾
14	3
4s.	9¾d.

(4)...

13s. 3¼d. = 637 farthings

£1 10s. 4d. = 1456 „

$$\frac{637}{1456} + \frac{91}{91} = \frac{7}{16} = ·4375$$

(5)...

$$\begin{array}{r} 2)\underline{1} \\ 28)\overline{24{\cdot}5} \\ 4)\overline{3{\cdot}875} \end{array}$$

3 qrs. 24½ lb. = ·96875 of a cwt.

ton
$$·4875 = 9 \text{ cwt. } 3 \text{ qrs.}$$
$$\underline{20}$$
$$9{\cdot}7500 \text{ cwt.}$$
$$\underline{4}$$
$$3{\cdot}0000 \text{ qrs.}$$

(6)...

fur.
$$·425 = 93\tfrac{1}{2} \text{ yds.}$$
$$\underline{220}$$
$$93{\cdot}500 \text{ yds.}$$

mile
$$·34375 = 605 \text{ yds.}$$
$$\underline{1760}$$
$$2062500$$
$$240625$$
$$34375$$
$$\overline{605{\cdot}00000} \text{ yds.}$$

605 yds.—93½ yds. = 511½ yards

(7)...

$$30\tfrac{1}{4} = 30{\cdot}25)\overline{\begin{array}{l}8)\underline{1}\\15{\cdot}125\end{array}}$$
$$40)\overline{25{\cdot}5}$$
$$4)\overline{1{\cdot}6375}$$

1 ro. 25 per. 15⅛ yds. = ·409375 of an acre

(8)...

$$4)\underline{2}$$
$$2)\overline{1{\cdot}5}$$
$$4)\overline{2{\cdot}75}$$
$$8)\overline{5{\cdot}6875}$$

5 bu. 2 pks. 1 gal. 2 qts. = ·7109375 of a quarter

(9)...

week
$$·59375 = 4 \text{ days } 3 \text{ hours } 45 \text{ min.}$$
$$\underline{7}$$
$$4{\cdot}15625 \text{ da.}$$
$$\underline{24}$$
$$3{\cdot}75000 \text{ hrs.}$$
$$\underline{60}$$
$$45{\cdot}000000 \text{ min.}$$

$$(10)\dots \quad \overset{\text{cwt.}}{\cdot 65625} \;:\; \overset{\text{cwt.}}{5\cdot 875} \;::\; \overset{\pounds}{2\cdot 75625} \;:\; \cdot x$$

$$x = \frac{\overset{1\cdot175}{\cancel{5\cdot875}} \times \overset{21}{\cancel{2\cdot75625}}}{\underset{5}{\cancel{\cdot65625}}} = \pounds 24\cdot675 = \pounds 24 \; 13s. \; 6d.$$

EXERCISE CX.

(1)...

$$2s. \; 2\tfrac{1}{2}d. = 106 \text{ farthings}$$

$$\pounds 286 \; 15s. \; 0\tfrac{1}{2}d. = 275282 \text{ farthings}$$

$$275282 \div 106 = \pounds 2597$$

(2)...

$$19 \text{ miles} = 1203840 \text{ inches}$$

$$1203840 \div 28\tfrac{1}{2} = 42240 \text{ steps}$$

(3)...

		s. d.			£	s.	d.	
1.	4	0	$= \tfrac{1}{5}$ of £1	5347	0	0	= value at £1 each
		6	$= \tfrac{1}{8}$ of 4s.	1069	8	0	
		4	$= \tfrac{1}{12}$ of 4s.	133	13	6	
	1$\tfrac{1}{2}$		$= \tfrac{1}{4}$ of 6d.	89	2	4	
				33	8	4$\tfrac{1}{2}$	
				£1325	12	2$\tfrac{1}{2}$	

			£	s.	d.	
2.	2 qrs.	$= \tfrac{1}{2}$ of 1 cwt.	2	12	6	per cwt.
					$3 \times 11 = 33$	
			7	17	6	
					11	
			86	12	6	
	1 qr.	$= \tfrac{1}{2}$ of 2 qrs.	1	6	8	
	7 lb.	$= \tfrac{1}{4}$ of 1 qr.	0	13	1$\tfrac{1}{2}$	
	3$\tfrac{1}{2}$ lb.	$= \tfrac{1}{2}$ of 7 lb.	0	3	3$\tfrac{3}{8}$	
			0	1	7$\tfrac{11}{16}$	
			£88	16	9$\tfrac{9}{16}$	

$$£\ \ \ s.\ \ \ d.$$

3.   3 17 10 per oz.

$$4 \times 7 + 1 = 29$$

——————
15 11 4
7
——————

dwts. grs.
10 0 = ½ of 1 oz. | 108 19 4
2 12 = ¼ of 10 dwts. | 3 17 10
1 6 = ½ of 2½ dwts. | 1 18 11
                     | 0 9 8¾
                     | 0 4 10⅜
——————————
£115 10 8⅛

$$£\ \ \ s.\ \ \ d.$$

(4)...   10 15 0
12
——————
129 0 0 value of 12 cows
cash 47 12 6
——————
35 { 5)81 7 6 value of 35 sheep
   { 7)16 5 6
——————
£2 6 6 value of 1 sheep

$$£\ \ \ s.\ \ \ d.$$

(5)...   52 10 0 per acre
5
——————
262 10 0
2 roods   = 26 5 0
1 rood   = 13 2 6
20 perches   = 6 11 3
5   „   = 1 12 9¾
2   „   = 0 13 1½
——————
£310 14 8¼ value of A's field

$$£\ \ \ s.\ \ \ d.$$

65 0 0 per acre
4
——————
260 0 0
2 roods   = 32 10 0
1 rood   = 16 5 0
5 perches = 2 0 7½
——————
£310 15 7½ value of B's field
310 14 8¼
——————
B's field is worth   11¼d. more than A's

	hor. da.		hor. da.		£	s.	d.		
(6)...	7×5	:	13×63	::	3	1	3	:	x

$$\begin{array}{r} 20 \\ \hline 61 \\ 12 \\ \hline 735 \end{array}$$

$$x = \frac{13 \times \overset{9}{\cancel{63}} \times \overset{147}{\cancel{735}}}{7 \times \cancel{5}} = 17199d. = £71 \ 13s. \ 3d.$$

(7)... From April 29th to September 22nd = 146 days

$$5 \text{ per cent.} = \tfrac{1}{20})\overset{£}{125}$$
$$\overline{£6 \quad 5s.} \text{ interest for 1 year}$$

da.		da.		£	s.
$\cancel{365}$	:	$\cancel{146}$	::	6	5
5		2			2

$$5)\overline{12 \quad 10}$$
$$\overline{£2 \quad 10s.}$$

		£	s.	d.
(8)...	$76\frac{1}{2}$ lb. at 4s. 6d. per lb. =	17	4	3
	cost =	15	18	9
	profit = £1	5	6

£	s.	d.		£	s.	d.				
15	18	9	:	1	5	6	::	100	:	8 per cent.

			£	s.	d.
(9)...	1 per cent. =	$\frac{1}{100}$	848	6	8
	$\frac{1}{8}$ „ =	$\frac{1}{8}$	8	9	8
			1	1	$2\frac{1}{2}$
			£9	10	$10\frac{1}{2}$

S

(10)...

$$43046721(6561$$
$$36$$
$$125)\ \overline{704}$$
$$625$$
$$1306)\ \overline{7967}$$
$$7836$$
$$13121)\ \overline{13121}$$
$$13121$$

$$387420489(729$$
$$343$$
$$7^2 \times 300 = 14700)\ \overline{44420}$$
$$29400 = 14700 \times 2$$
$$840 = 7 \times 30 \times 2^2$$
$$8 = 2^3$$
$$\overline{30248}\ \text{subtrahend}$$
$$72^2 \times 300 = 1555200)\overline{14172489}$$
$$13996800 = 1555200 \times 9$$
$$174960 = 72 \times 30 \times \times 9^2$$
$$729 = 9^3$$
$$\overline{14172489}$$

EXERCISE CXI.

(1)...

$$\frac{\overset{17}{\cancel{187}} \times \overset{51}{\cancel{6120}}}{\underset{4}{\underset{44}{\cancel{\underset{7}{\cancel{5280}}}}}} = \frac{867}{4} = 216\tfrac{3}{4} \text{ statute miles}$$

(2)...

			£	s.	d.
$\cancel{3745}$:	$\cancel{4815}$ ::		118	2	6
7	9				9
		7)1063	2	6
		£151	17	6

(3)...

			$s.$	$d.$		$\pounds$	$s.$	$d.$
$14\frac{1}{2}$ yds.	Lutestring.........		3	9	=	2	14	$4\frac{1}{2}$
$1\frac{3}{4}$ „	Satin		4	3	=		7	$5\frac{1}{4}$
$5\frac{1}{2}$ „	Silk Velvet		8	6	=	2	6	9
$7\frac{1}{2}$ „	Cotton „		1	9	=		13	$1\frac{1}{2}$
18 „	Calico			$6\frac{1}{4}$	=		9	$4\frac{1}{2}$
$7\frac{1}{4}$ „	Ribbon			$10\frac{1}{2}$	=		6	$6\frac{3}{4}$
$3\frac{3}{4}$ „	Lace		2	6	=		9	$4\frac{1}{2}$
						$\pounds 7$	7	0

(4)...

$$\overset{\pounds}{17\cdot85)11\cdot15625(}\cdot625 \text{ of } \pounds 1 = 12s.\ 6d. \text{ per ton}$$
$$10710$$
$$\overline{4462}$$
$$3570$$
$$\overline{8925}$$
$$8925$$

(5)...

	$s.$	$d.$	
	14	6	per gallon
	$6 \times 6 + 1$	= 37	
	4 7	0	
		6	
	26 2	0	
	14	6	
$\frac{1}{2}$ gal. =	7	3	
$\frac{1}{12}$ „ =	1	$2\frac{1}{2}$	
	$\pounds 27$ 4	$11\frac{1}{2}$	

(6)...$19\frac{5}{6}$ yds. $\times 19 = 376\frac{5}{6}$ yds. $\pounds 7$ 11s. $4\frac{1}{2}d. = \pounds 7\frac{91}{160}$

$$\begin{array}{ccccccc} \text{yds.} & & \text{yds.} & & \pounds & & \\ 17\frac{3}{10} & : & 376\frac{5}{6} & :: & 7\frac{91}{160} & : & x \end{array}$$

$$x = \frac{\overset{}{10}}{17\cancel{3}} \times \frac{2261}{6} \times \frac{\overset{7}{1211}}{\underset{16}{160}} = \pounds\frac{15827}{96} = \pounds 164\ 17s.\ 3\frac{1}{2}d.$$

(7)...

$$
\begin{array}{ccc}
\pounds & s. & d. \\
388 & 0 & 4\tfrac{1}{2} \text{ amount} \\
343 & 0 & 0 \text{ principal} \\
\hline
\pounds45 & 0 & 4\tfrac{1}{2} \text{ int. for } 3\tfrac{1}{2} \text{ years}
\end{array}
$$

$\pounds45$ 0s. $4\tfrac{1}{2}d. \div 3\tfrac{1}{2} = \pounds12$ 17s. 3d., int. for 1 year

$$
\begin{array}{ccccccccc}
\pounds & & \pounds & & & \pounds & s. & d. \\
343 & : & 100 & :: & & 12 & 17 & 3 & : & \pounds3\tfrac{3}{4} \text{ per cent.}
\end{array}
$$

(8)...Amount of $\pounds100$ in 8 months at $4\tfrac{1}{2}$ per cent. per annum
$$= \pounds100 + (\pounds4\tfrac{1}{2} \times \tfrac{2}{3}) = \pounds103$$

$$
\begin{array}{ccccccc}
\pounds & & \pounds & s. & & \pounds \\
103 & : & 190 & 10 & :: & 100 & : \quad \text{present worth} \\
 & & 20 & & & \\
 & & 3810 & & &
\end{array}
$$

Present worth $= \dfrac{3810 \times 100}{103} = \dfrac{381000}{103}s. = \pounds184$ 19s. $0\tfrac{36}{103}d.$

(9)...

$$
\begin{array}{r}
531677222244(729162 \\
49 \\
\hline
142)\ \overline{416} \\
284 \\
\hline
1449)\overline{13277} \\
13041 \\
\hline
14581)\ \overline{23622} \\
14581 \\
\hline
145826)\ \overline{904122} \\
874956 \\
\hline
1458322)\ \overline{2916644} \\
2916644 \\
\hline
\end{array}
$$

$$20346417(273$$
$$8$$
$$2^2 \times 300 = 1200 \overline{)12346}$$
$$\begin{array}{r} 8400 = 1200 \times 7 \\ 2940 = 2 \times 30 \times 7^2 \\ 343 = 7^3 \\ \hline 11683 \text{ subtrahend} \end{array}$$
$$27^2 \times 300 = 218700 \overline{)663417}$$
$$\begin{array}{r} 656100 = 218700 \times 3 \\ 7290 = 27 \times 30 \times 3^2 \\ 27 = 3^3 \\ \hline 663417 \end{array}$$

$$(10)\ldots \quad \frac{4+\sqrt{12}}{4-\sqrt{12}} \times \frac{4+\sqrt{12}}{4+\sqrt{12}} = \frac{28+8\sqrt{12}}{16-12} = 7+2\sqrt{12}$$

$$7+2 \cdot \overline{12} = 7+(2 \times 3\cdot4641)$$
$$= 7+6\cdot9282$$
$$= 13\cdot9282$$

EXERCISE CXII.

$$(1)\ldots \qquad \begin{array}{c} £ \quad\ s. \quad d. \\ 924\overline{)5250} \quad 8 \quad 9(£5\ 13s.\ 7\tfrac{3}{4}d. \\ 4620 \\ \hline 630 \\ 20 \end{array}$$

$$924\overline{)12608}(13s.$$
$$\begin{array}{r} 924 \\ \hline 3368 \\ 2772 \\ \hline 596 \\ 12 \end{array}$$
$$924\overline{)7161}(7d.$$
$$\begin{array}{r} 6468 \\ \hline 693 \\ 4 \end{array}$$
$$924\overline{)2772}(3\text{ far.}$$
$$2772$$

$$924 = 12 \times 11 \times 7$$

$$\begin{array}{r} £ \quad\ s. \quad d. \\ 12\overline{)5250} \quad 8 \quad 9 \\ \hline 11\overline{)437} \quad 10 \quad 8\tfrac{3}{4} \\ \hline 7\overline{)39} \quad 15 \quad 6\tfrac{1}{4} \\ \hline £5 \quad 13 \quad 7\tfrac{3}{4} \end{array}$$

$$
\begin{array}{c}
\qquad\quad £\quad s.\quad d. \\
(2)\ldots\quad 18)\overline{9\ \ 19\ \ 6} \\
\qquad\quad\ \ \overline{11\ \ \ 1} \\
\qquad\qquad\quad 11 \\
\qquad\ \ \overline{£6\ \ \ 1\ \ 11}
\end{array}
\qquad
\begin{array}{c}
\qquad\quad £\quad s.\quad d. \\
13)\overline{24\ \ \ 7\ \ \ 6} \\
\overline{1\ \ 17\ \ \ 6} \\
\qquad\quad 9 \\
\overline{£16\ \ 17\ \ \ 6}
\end{array}
$$

£16 17s. 6d. — £6 1s. 11d. = £10 15s. 7d.

$$
\begin{array}{c}
\qquad\ f. \\
(3)\ldots\quad 4)\overline{1} \\
12)\overline{5\cdot 25} \\
20)\overline{\ \cdot 4375} \\
5\tfrac{1}{4}d. = \cdot 021875 \text{ of a sov.}
\end{array}
\qquad
\begin{array}{c}
\qquad\ oz. \\
16)\overline{10} \\
28)\overline{\ 2\cdot 625} \\
4)\overline{\ \ \cdot 09375} \\
2\,lb.\,10\,oz. = \cdot 0234375 \text{ of a cwt.}
\end{array}
$$

$$
\begin{array}{r}
(4)\ldots\quad 5\cdot 013 \\
\cdot 075 \\
\hline
25065 \\
35091 \\
\hline
\end{array}
$$

$$
1\cdot 062)\overline{\cdot 375975000}(\cdot 354025\ldots\ldots
$$

$$
\begin{array}{r}
3186 \\
\hline
5737 \\
5310 \\
\hline
4275 \\
4248 \\
\hline
2700 \\
2124 \\
\hline
5760 \\
5310 \\
\hline
350
\end{array}
$$

$$
\frac{5\cdot 013 \times \cdot 075}{1\cdot 062} = \cdot 354025\ldots\ldots
$$

$$
\begin{array}{ccccc}
\text{men}\quad \text{da.}\quad \text{ho.} & & \text{men}\quad \text{da.}\quad \text{ho.} & & \text{yds.}\quad \text{yds.} & & \text{yds.}\quad \text{yds.} \\
(5)\ldots 5\times 4\tfrac{1}{2}\times 12 & : & x\times 4\tfrac{1}{3}\times 13\tfrac{1}{2} & :: & 270\times 240 & : & 468\times 180 \\
6\qquad 2 & & 6\qquad 2 & & & & \\
\overline{27}\quad \overline{24} & & 26\qquad 27 & & & &
\end{array}
$$

$$
x = \frac{\cancel{5}\times \cancel{27}\times \cancel{24}\times \cancel{468}\times \cancel{180}}{\cancel{26}\times \cancel{27}\times \cancel{270}\times \cancel{240}} = 6 \text{ men}
$$

(6)...

$$4 \text{ per cent.} = \tfrac{1}{25}$$
$$\tfrac{1}{4} \quad \text{,,} \quad = \tfrac{1}{16}$$

£	s.	d.
1075	16	8
43	0	8
2	13	9½
45	14	5½

interest for 1 year

$3\tfrac{1}{2}$

137	3	4½
22	17	2¾
£160	0	7¼

interest for $3\tfrac{1}{2}$ years

(7)... Amount of £100 in 5 months at $4\tfrac{1}{2}$ per cent. per annum
$$= £100 + (£4\tfrac{1}{2} \times \tfrac{5}{12}) = £101 \ 17s. \ 6d.$$

£	s.	d.		£	s.		£		
101	17	6	:	287	10	::	100	:	x
8				8					
815				2300					

$$x = \frac{2300 \times \overset{20}{\cancel{100}}}{\underset{163}{\cancel{815}}} = £\frac{\overset{4600}{}}{163} = £282 \ 4s. \ 2\tfrac{10}{163}d.$$

(8)...

	100						s.	d.
	20							
	$\cancel{120}$	:	$\times\cancel{100}$	::			3	6
	6		5					5

$$6)\overline{17 \ 6}$$

Cost price $= \overline{2s. 11d.}$

(9)...

$$1 \text{ cwt. } 1 \text{ qr. } 25 \text{ lb.} = 165 \text{ lb.}$$

	£	s.	d.
165 lb. at $4\tfrac{1}{2}$ per lb. =	3	1	10½
cost =	2	15	0
profit =		6s.	10½d.

£	s.		s.	d.				
2	15	:	6	10½	::	100	:	12½ per cent.

(10)...   2450 yds. Calico ......$7\frac{1}{2}$ = 76 11 3
            2325 „   „   ......9 = 87 3 9
                 $2\frac{1}{2}$ per cent. = $\frac{1}{40}$)163 15 0
                                          £4 1 10$\frac{1}{2}$

d.   £   s. d.

EXERCISE CXIII.

(1)... $14\frac{1}{2}$ lb. Tea ......3 8 = 2 13 2
           $10\frac{1}{2}$ „ Coffee ...1 6 = 0 15 9
           25 „ Sugar ...0 $5\frac{1}{2}$ = 0 11 $5\frac{1}{2}$
                                     £4 · 0 $4\frac{1}{2}$

s. d.   £ s. d.

           $27\frac{1}{2}$ yds. Linen Sheeting ......1 8 = 2 5 10
           13 „ Flannel ....1 6 = 0 19 6
           19 „ Calico...............0 $9\frac{1}{2}$ = 0 15 $0\frac{1}{2}$
                                      £4 0 $4\frac{1}{2}$

s. d.   £ s. d.

The debts are equal

(2)...   £   s. d.
                       1 15 0 per acre
                                $8 \times 8 \times 4 + 1 = 257$
                      ————————
                      14   0   0
                            8
                      ————————
                      112   0   0
                             4
           ————————————
1 rood = $\frac{1}{4}$ of 1 ac. | 448 0 0
20 per. = $\frac{1}{2}$ of 1 rood| 1 15 0
10 „ = $\frac{1}{2}$ of 20 per.| 0   8 9
                              | 0   4 $4\frac{1}{2}$
                              | 0   2 $2\frac{1}{4}$
           ————————————
           £450 10 $3\frac{3}{4}$

£   s.   d.

(3)... $3\frac{8}{9}$ inches $= \dfrac{\overset{7}{\cancel{35}}}{9} \times \dfrac{1}{\underset{9}{\cancel{45}}} = \dfrac{7}{81}$ of an English ell

$\dfrac{5}{27}$ E. ell $= \dfrac{5}{27}$ of $3\frac{3}{4}$ ft. $= \dfrac{5}{\underset{9}{\cancel{27}}} \times \dfrac{\overset{5}{\cancel{15}}}{4} = \dfrac{25}{36}$ of a foot

(4)... ·671875 = 13 cwt. 1 qr. 21 lb.

$$\frac{20}{\overline{13\cdot437500}\text{ cwt.}}$$

$$\frac{4}{\overline{1\cdot750000}\text{ qr.}}$$

$$\frac{28}{\overline{21\cdot000000}\text{ lb.}}$$

$$\frac{29}{32}\text{ cwt.} = \frac{29}{32} \times \frac{4}{1} = \frac{29}{8}\text{ qr.} = 3\text{ qrs. }17\tfrac{1}{2}\text{ lb.}$$

$$
\begin{array}{ccc}
\text{cwt.} & \text{qrs.} & \text{lb.} \\
13 & 1 & 21 \\
 & 3 & 17\tfrac{1}{2} \\
\hline
\text{cwt. } 14 & 1 & 10\tfrac{1}{2}\text{ lb.}
\end{array}
$$

(5)...

$$\cdot 71818\ \&c. = \frac{718-7}{990} = \frac{711}{990} = \frac{79}{110}$$

$$\cdot 20756756\ \&c. = \frac{20756-20}{99900} = \frac{20736}{99900} = \frac{192}{925}$$

(6)...

$$
\begin{array}{cccccccccc}
\text{cwt.} & \text{qr.} & \text{lb.} & \text{mi.} & & \text{cwt.} & \text{qrs.} & \text{lb.} & \text{mi.} & & s. & d. \\
2 & 1 & 20 & \times 52\tfrac{1}{2} & : & 1 & 3 & 12 & \times 7 \times 97\tfrac{1}{2} & :: & 9 & 11 & : & x
\end{array}
$$

$$
\frac{4}{9} \qquad \frac{2}{105} \qquad \frac{4}{7} \qquad \frac{2}{195} \qquad \frac{12}{119}
$$

$$\frac{28}{272} \qquad\qquad \frac{28}{208}$$

$$x = \frac{\overset{13}{\cancel{208}} \times 7 \times \overset{13}{\cancel{195}} \times \overset{7}{\cancel{119}}}{\underset{17}{\cancel{272}} \times \underset{15}{\cancel{105}}} = 1183d. = \pounds4\ 18s.\ 7d.$$

(7)... £116 17s. 6d. ÷ 2$\tfrac{3}{4}$ = £42 10s. interest for 1 year

$$
\begin{array}{ccccccccccc}
\pounds & & \pounds & & \pounds & s. & & \pounds & s. \\
1000 & : & 100 & :: & 42 & 10 & : & 4 & 5 & = 4\tfrac{1}{4}\text{ per cent.}
\end{array}
$$

(8)...

$$
\begin{array}{rccc}
 & \pounds & s. & d. \\
100)1575 & 0 & 0 \\
\end{array}
$$

2s. 6d. = $\tfrac{1}{8}$ of £1 | 15 15 0 amount at £1 per cent.

1s. 0d. = $\tfrac{1}{20}$ of £1 | 1 19 4$\tfrac{1}{2}$

| 15 · 9

£2 15 1$\tfrac{1}{2}$ amount at 3s. 6d. per cent.

(9)...

$$
\begin{array}{llll}
s. & d. & & \pounds \quad s. \\
2 & 6\times25\times52 &=& 162 \quad 10 \\
3 & 6\times17\times52 &=& 154 \quad 14 \\
4 & 0\times 7\times52 &=& 72 \quad 16 \\
\end{array}
$$

5 per cent. $= \tfrac{1}{20}$)$\overline{390 \quad 0}$

commission £19 10s.

(10)...

$$\frac{1}{5}+\left(\frac{5}{24}\text{ of }\frac{4}{5}\right) = \frac{1}{5}+\frac{1}{6} = \frac{6+5}{30} = \frac{11}{30}$$

$$1-\tfrac{11}{30} = \tfrac{19}{30}$$

$$\tfrac{19}{30} \;:\; 1 \;::\; \overset{\pounds}{2850} \;:\; x$$

$$x = \frac{30}{19}\times\frac{\overset{150}{2850}}{1} = \pounds4500$$

EXERCISE CXIV.

(1)...1. $\dfrac{3\frac{7}{25}-1\cdot016}{2\cdot76+5\frac{5}{12}} = \dfrac{3\frac{7}{25}-1\frac{2}{125}}{2\frac{19}{25}+5\frac{5}{12}} = \dfrac{3\frac{35}{125}-1\frac{2}{125}}{2\frac{228}{300}+5\frac{125}{300}} = \dfrac{2\frac{33}{125}}{8\frac{53}{300}}$

$$= \frac{\frac{283}{125}}{\frac{2453}{300}} = \frac{283\times\overset{12}{300}}{2453\times\underset{5}{125}} = \frac{3396}{12265}$$

2. $\dfrac{\frac{3}{5}(4\frac{1}{3}+3\frac{1}{4})}{\frac{2}{7}(8\frac{1}{5}-5\frac{1}{6})} = \dfrac{\frac{3}{5}(4\frac{4}{12}+3\frac{3}{12})}{\frac{2}{7}(8\frac{6}{30}-5\frac{5}{30})} = \dfrac{\frac{3}{5}\text{ of }7\frac{7}{12}}{\frac{2}{7}\text{ of }3\frac{1}{30}} = \dfrac{\frac{91}{20}}{\frac{13}{15}}$

$$= \frac{\overset{7}{91}\times\overset{3}{15}}{\underset{4}{13}\times\underset{}{20}} = \frac{21}{4} = 5\tfrac{1}{4}$$

(2)...

$$\frac{7}{8\frac{1}{2}}\times11\frac{1}{9}\times\frac{3\frac{5}{6}}{5}\times5\frac{6}{7}\times3\frac{3}{11}\times\frac{7\frac{1}{3}}{5\frac{3}{4}}\times1\frac{1}{2}\times\frac{9}{8\frac{8}{11}}$$

$$= \frac{\overset{5}{35}}{\underset{}{41}}\times\frac{\overset{4}{100}}{9}\times\frac{23}{\underset{6}{30}}\times\frac{41}{7}\times\frac{\overset{4}{39}}{11}\times\frac{\overset{8}{88}}{\underset{3}{69}}\times\frac{\overset{6}{39}}{25}\times\frac{3}{\underset{4}{37}} = 24$$

(3)...

$$\text{min.}$$

$$60)18$$

$$24)\overline{\ 6{\cdot}3}$$

$$7)\overline{\ \ {\cdot}2625}$$

6 hrs. 18 min. = ·0375 of a week

(4)...

	£	s.	d.
	1	16	9 per cwt.

$$6 \times 7 + 1 = 43$$

	11	0	6
			7
	77	3	6

		£	s.	d.
2 qrs. = ½ of 1 cwt.		1	16	9
1 qr. = ½ of 2 qrs.		0	18	4½
16 lb. = ⅐ of 1 cwt.		0	9	2¼
8 lb. = ½ of 16 lb.		0	5	3
		0	2	7½
	£	80	15	8¼

(5)...

$$\frac{17}{28}\text{ gui.} = \frac{17}{\cancel{28}_{4}} \times \frac{\cancel{21}^{3}}{1} = \frac{51}{4}\,s. = 12s.\ 9d.$$

$$\frac{33}{40}\text{ cr.} = \frac{33}{\cancel{40}_{8}} \times \frac{\cancel{5}}{1} = \frac{33}{8}\,s. = 4s.\ 1\tfrac{1}{2}d.$$

sov.		fl.
·453125 = 9s. 0¾d.		·34375 = 8¼d.
20		2
9·062500s.		·68750s.
12		12
0·750000d.		8·25000d.
4		4
3·000000 far.		1·00000 far.

	s.	d.
	12	9
	9	0¾
	4	1½
		8¼
£1	6	7½

(6)...
$$\begin{array}{ccccccc} \text{per. we.} & & \text{per. we.} & & \pounds & s. & \\ 5\times4 & : & 9\times13 & :: & 15 & 15 & : & x \\ & & & & & 20 & \\ \hline & & & & & 315 & \end{array}$$

$$x = \frac{9\times13\times\overset{63}{\cancel{315}}}{\cancel{5}\times\cancel{4}} = \frac{7371}{4}s. = \pounds92\ 2s.\ 9d.$$

(7)...
$$\begin{array}{lrcl} & \text{men} & \text{wks.} & \\ \text{A} & 160\times7 & = & 1120 \\ \text{B} & 220\times9 & = & 1980 \\ \hline & & & 3100 \end{array}$$

$$\begin{array}{ccccccc} & & & & \pounds & & \pounds & \\ 3100 & : & 1120 & :: & 3875 & : & 1400 & \text{A's share} \\ 3100 & : & 1980 & :: & 3875 & : & 2475 & \text{B's share} \end{array}$$

(8)...
$$\begin{array}{ccccccccc} \pounds & & \pounds & & \pounds & s. & d. & & \\ \cancel{100} & : & \cancel{1625} & :: & 81 & 7 & 6 & & \\ 4 & & 65 & & & & & 5\times13 = 65 \\ \hline & & & & 406 & 17 & .6 & & \\ & & & & & & 13 & & \\ \hline & & & 4) & 5289 & 7 & 6 & & \\ \hline & & & & \pounds1322 & 6 & 10\tfrac{1}{2} & & \end{array}$$

(9)...
$$\begin{array}{lrcccc} & & & \pounds & s. & d. \\ 75\text{ lb. Tea at }4s.\ 3d.\text{ per lb.} & = & & 15 & 18 & 9 \\ \text{cost} & = & & 14 & 1 & 3 \\ \text{profit} & = & & \pounds1 & 17 & 6 \end{array}$$

$$\begin{array}{cccccccccc} \pounds & s. & d. & & \pounds & s. & d. & & & \\ 14 & 1 & 3 & : & 1 & 17 & 6 & :: & 100 & : & 13\tfrac{1}{3}\text{ per cent.} \end{array}$$

(10)...
$$61013446081(247009$$
$$4$$
$$44)\overline{210}$$
$$176$$
$$487)\overline{\ 3413}$$
$$3409$$
$$494009)\overline{\quad 4446081}$$
$$4446081$$

$$247009(497$$
$$16$$
$$89)\overline{\ 870}$$
$$801$$
$$987)\overline{6909}$$
$$6909$$

$$\therefore \sqrt{61013446081} = 497$$

EXERCISE CXV.

(1)...

$$(4\tfrac{3}{8})^2 \times (6\tfrac{2}{5})^3 = \overset{7}{\frac{\cancel{35}}{\cancel{8}}} \times \overset{7}{\frac{\cancel{35}}{\cancel{8}}} \times \overset{4}{\frac{\cancel{32}}{\cancel{5}}} \times \overset{4}{\frac{\cancel{32}}{\cancel{5}}} \times \frac{32}{5} = \frac{25088}{5} = 5017\tfrac{3}{5}$$

(2)...

$$\cdot 26351351 \ \&c. = \frac{26351-26}{99900} = \frac{26325}{99900} = \frac{39}{148}$$

$$\cdot 734774774 \ \&c. = \frac{734774-734}{999000} = \frac{734040}{999000} = \frac{2039}{2775}$$

(3)...

			s.	d.	
	1.		11	8	per yard
				$5 \times 9 + 2 = 47$	
			2 18	4	
				9	
			26 5	0	
			1 3	4	
$\frac{1}{2}$ yd. or $\frac{8}{16}$ yd. =		0	5	10	
$\frac{1}{8}$ yd. or $\frac{2}{16}$ yd. =		0	1	$5\frac{1}{2}$	
$\frac{1}{16}$ yd. =		0	0	$8\frac{3}{4}$	
		£27	16	$4\frac{1}{4}$	

		£	s.	d.	
2.	2 qrs. = $\frac{1}{2}$ of 1 cwt.	3	5	4	per cwt.
				13	
		42	9	4	
14 lb. = $\frac{1}{4}$ of 2 qrs.		1	12	8	
7 lb. = $\frac{1}{2}$ of 14 lb.		0	8	2	
$1\frac{3}{4}$ lb. = $\frac{1}{4}$ of 7 lb.		0	4	1	
		0	1	$0\frac{1}{4}$	
		£44	15	$3\frac{1}{4}$	

$$\begin{array}{r} \pounds \quad s. \quad d \\ \textbf{3.} \quad 45 \quad 0 \quad 0 \end{array}$$

$$4 \times 4 + 3 = 19$$

$$\begin{array}{r} \overline{180 \quad 0 \quad 0} \\ 4 \end{array}$$

	$\pounds$	$s.$	$d.$
	720	0	0
3 ro. $= \frac{1}{4}$ of 3 acres	135	0	0
30 per. $= \frac{1}{4}$ of 3 roods	33	15	0
$3\frac{3}{4}$ per. $= \frac{1}{8}$ of 30 per.	8	8	9
	1	1	$1\frac{1}{8}$
	$\pounds 898$	4	$10\frac{1}{8}$

(4)...
$$\begin{array}{ccccccc} \text{cop.} & \text{pa.} & & \text{cop.} & \text{pa.} & & \text{re.} \\ 1200 \times 32 & & : & 1500 \times 272 & & :: & 5 & : & x \end{array}$$

$$x = \frac{\overset{5}{\cancel{1500}} \times \overset{17}{\cancel{272}} \times 5}{\underset{4}{\cancel{1200}} \times \underset{2}{\cancel{32}}} = \frac{425}{8} = 53\frac{1}{8} \text{ reams}$$

(5)...

Let 6 = wife's share
then 3 = each son's share
and 2 = each daughter's share

$$6 + (3 \times 3) + (2 \times 4) = 23 = \pounds 23000$$

$$\begin{array}{ccccccc} & & & & \pounds & & \pounds \\ 23 & : & 6 & :: & 23000 & : & 6000, \text{ wife's share} \\ 23 & : & 3 & :: & 23000 & : & 3000, \text{ each son's share} \\ 23 & : & 2 & :: & 23000 & : & 2000, \text{ each daughter's share} \end{array}$$

(6)...

$$2\frac{1}{2} \text{ per cent.} = \frac{1}{40}$$
$$1\frac{1}{4} \text{ ,, \quad ,, } = \frac{1}{2}$$

	$\pounds$	$s.$	$d.$	
	131	5	0	= 125 guineas
	3	5	$7\frac{1}{2}$	
	1	12	$9\frac{3}{4}$	
	$\pounds 4$	18	$5\frac{1}{4}$	interest for 1 year

$$\begin{array}{ccccccc} \text{da.} & & \text{yrs. da.} & & \text{da.} & & \pounds \quad s. \quad d. \\ \underset{5}{\cancel{365}} & : & 2\ 219 & = \underset{13}{\cancel{949}} & :: & 4 \quad 18 \quad 5\frac{1}{4} \\ & & & & & & 13 \end{array}$$

$$5) \overline{63 \quad 19 \quad 8\frac{1}{4}}$$
$$\pounds 12 \quad 15 \quad 11\frac{1}{4}$$

(7)...

$$\begin{array}{cc} 100 & 100 \\ 8 & 20 \end{array}$$

$$\cancel{108} \; : \; \cancel{120} \; :: \; \begin{array}{cc} s. & d. \\ 11 & 3 \end{array}$$

$$\begin{array}{cc} 9 & 10 \qquad \qquad 10 \end{array}$$

$$\therefore \quad 9)\overline{5\ 12\ 6}$$

$$\overline{12s.\ 6d.\ \text{per yard}}$$

(8)...

$$\sqrt{1395\tfrac{109}{196}} = \sqrt{\tfrac{273529}{196}} = \tfrac{523}{14} = 37\tfrac{5}{14}$$

$$\sqrt{2780\tfrac{181}{225}} = \sqrt{\tfrac{625681}{225}} = \tfrac{791}{15} = 52\tfrac{11}{13}$$

(9)...

$$286191179(659$$
$$216$$
$$6^2 \times 300 = 10800)\overline{70191}$$
$$\overline{54000} = 10800 \times 5$$
$$4500 = 6 \times 30 \times 5^2$$
$$125 = 5^3$$
$$\overline{58625}\ \text{subtrahend}$$
$$65^2 \times 300 = 1267500)\overline{11566179}$$
$$\overline{11407500} = 1267500 \times 9$$
$$157950 = 65 \times 30 \times 9^2$$
$$729 = 9^3$$
$$\overline{11566179}$$

(10)...

$$\frac{8+\sqrt{14}}{8-\sqrt{14}} \times \frac{8+\sqrt{14}}{8+\sqrt{14}} = \frac{78+16\sqrt{14}}{50}$$

$$= 1.56 + (\tfrac{8}{25}\ \text{of}\ 3.7416)$$

$$= 1.56 + 1.1973$$

$$= 2.7573 \ldots$$

Or thus,

$$\frac{8+\sqrt{14}}{8-\sqrt{14}} = \frac{8+3.74165}{8-3.74165} = \frac{11.74165}{4.25835}$$

$$= 2.7573 \ldots$$

EXERCISE CXVI.

(1)...
$$
\begin{array}{ccccc}
\text{E. deg.} & & \text{E. deg.} & & \text{F. deg.} \\
9\!\!\!/0 & : & 137\cdot52 & :: & 10\!\!\!/0\!\!\!/ \\
9 & & 10 & & 10 \\
\end{array}
$$

$$
9)\overline{1375\cdot2}
$$
$$
152\cdot8 \text{ F. degrees}
$$

(2)...
$$
\begin{array}{ccccccc}
\text{cwt.} \ \text{mi.} & & \text{mi.} & & s. \ \ d. & & s. \ \ d. \\
2\tfrac{1}{2}\times125 & : & x\times87\tfrac{1}{2} & :: & 8 \ \ 4 & : & 7 \ \ 7 \\
\ \ 4 \qquad 2 & & 2 & & 12 & & 12 \\
\overline{10} \quad \overline{250} & & \overline{175} & & \overline{100} & & \overline{91} \\
\end{array}
$$

$$
x = \frac{\cancel{10}\times\cancel{250}\times\cancel{91}}{\cancel{175}\times\cancel{100}} = 13 \text{ qrs.} = 3\tfrac{1}{4} \text{ cwt.}
$$

(3)...
$$
\begin{array}{ccccccc}
\text{ho.} \ \text{da.} & & \text{ho.} & & \text{bu.} \ \text{pks.} & & \text{bu.} \ \text{pks} \\
5\times9 & : & 17\times x & :: & 8 \ \ 1\tfrac{3}{4} & : & 66 \ \ 3\tfrac{3}{4} \\
& & & & 4 & & 4 \\
& & & & \overline{33} & & \overline{267} \\
& & & & 4 & & 4 \\
& & & & \overline{135} & & \overline{1071} \\
\end{array}
$$

$$
x = \frac{\cancel{5}\times\cancel{9}\times\cancel{1071}}{\cancel{17}\times\cancel{135}} = 21 \text{ days}
$$

(4)...
$$
\begin{array}{ccccccc}
\text{per. da.} & & \text{per. da.} & & \pounds \ \ \ s. & & \\
5\times28 & : & 9\times25 & :: & 87 \ \ 10 & : & x \\
& & & & 20 & & \\
& & & & \overline{1750} & & \\
\end{array}
$$

$$
x = \frac{9\times\cancel{25}\times\cancel{1750}}{\cancel{5}\times\cancel{28}} = \frac{5625}{2}s. = \pounds140 \ 12s. \ 6d.
$$

(5)... $13\frac{7}{9}+8\frac{6}{7} = 13\frac{49}{63}+8\frac{54}{63} = 22\frac{40}{63}$, sum

$13\frac{7}{9}-8\frac{6}{7} = 13\frac{49}{63}-8\frac{54}{63} = 4\frac{58}{63}$, difference

$13\frac{7}{9}\times8\frac{6}{7} = \frac{124}{9}\times\frac{62}{7} = \frac{7688}{63} = 122\frac{2}{63}$, product

$$13\frac{7}{9}\div8\frac{6}{7} = \frac{\overset{2}{\cancel{124}}}{9}\times\frac{7}{\cancel{62}} = \frac{14}{9} = 1\frac{5}{9}\text{, quotient}$$

(6)... $\cdot35 = \frac{35}{100}\div\frac{5}{5} = \frac{7}{20}$; $\cdot056 = \frac{56}{1000}\div\frac{8}{8} = \frac{7}{125}$;

$\cdot275 = \frac{275}{1000}\div\frac{25}{25} = \frac{11}{40}$; $\cdot0155 = \frac{155}{10000}\div\frac{5}{5} = \frac{31}{2000}$.

(7)... 5 per cent. $= \frac{1}{20}$

	£	s.	d.	
4 mo. $= \frac{1}{3}$ yr.	736	10	0	
	36	16	6	int. for 1 year
1 mo. $= \frac{1}{4}$ of 4 mo.	12	5	6	
	3	1	$4\frac{1}{2}$	
	£15	6	$10\frac{1}{2}$	int. for 5 mo.

(8)...Amount of £100 in 8 months at $3\frac{3}{4}$ per cent. per annum
$= £100+(£3\frac{3}{4}\times\frac{2}{3}) = £102$ 10s.

£	s.		£	s.		£		
102	10	:	59	15	::	100	:	present worth
20			20					
2050			1195					

$$\text{Present worth } \frac{1195\times\overset{2}{\cancel{100}}}{\underset{41}{\cancel{2050}}} = £\frac{2390}{41} = £58 \text{ } 5s. \text{ } 10\frac{10}{41}d.$$

T

(9)...
$$5755396111162929(75864327$$
$$49$$
$$145)\ \overline{855}$$
$$725$$
$$1508)\overline{13039}$$
$$12064$$
$$15166)\ \overline{97561}$$
$$90996$$
$$151724)\ \overline{656511}$$
$$606896$$
$$1517283)\ \overline{4961516}$$
$$4551849$$
$$15172862)\ \overline{40966729}$$
$$30345724$$
$$151728647)\overline{1062100529}$$
$$1062100529$$

(10)...   Let x = the mean proportional

Then   148   : x : : x :   333

$$x^2 = 148 \times 333$$
$$= 49284$$
$$\therefore x = 222$$

EXERCISE CXVII.

1. $\dfrac{3\frac{3}{4}}{8\frac{2}{5}} - \dfrac{5\frac{1}{7}}{10\frac{4}{5}} + \dfrac{2\frac{4}{7}}{6\frac{6}{11}} - \dfrac{1\frac{2}{9}}{8\frac{5}{9}} = \frac{25}{56} - \frac{10}{21} + \frac{11}{28} - \frac{1}{7}$

$$= \frac{75}{168} - \frac{80}{168} + \frac{66}{168} - \frac{24}{168}$$

$$= \frac{37}{168}$$

2. $\dfrac{3}{7} + \dfrac{3}{5} + \dfrac{4}{9} = \dfrac{135 + 189 + 140}{315} = \dfrac{464}{315}$

$$\dfrac{7}{9} + \dfrac{5}{7} + \dfrac{4}{5} = \dfrac{245 + 225 + 252}{315} = \dfrac{722}{315}$$

$$\dfrac{464}{315} \div \dfrac{722}{315} = \dfrac{\overset{232}{\cancel{464}}}{\cancel{315}} \times \dfrac{\cancel{315}}{\underset{361}{\cancel{722}}} = \dfrac{232}{361}$$

(2)...
$$\frac{11}{15}\text{ sov.} = \frac{11}{\overset{}{\underset{3}{\cancel{15}}}}\times\frac{\overset{4}{\cancel{20}}}{1} = \frac{44}{3}s. = 14^{s.}\ 8^{d.}$$

$$\tfrac{11}{16}\text{ gui.} = \tfrac{11}{16}\times\tfrac{21}{1} = \tfrac{231}{16}s. = 14\ 5\tfrac{1}{4}$$
$$\text{difference} = \overline{\qquad 2\tfrac{3}{4}d.}$$

(3)...£2·3125 = £2 6s. 3d.   11·6875 cr. = £2 18s. 5¼d.

$$\begin{array}{r}20\\\hline 6\cdot2500s.\\12\\\hline 3\cdot0000d.\end{array}\qquad\qquad\begin{array}{r}5\\\hline 3\cdot4375s.\\12\\\hline 5\cdot2500d.\\4\\\hline 1\cdot0000\text{ far.}\end{array}$$

$$\frac{7}{18}\text{ gui.} = \frac{7}{\underset{6}{\cancel{18}}}\times\frac{\overset{7}{\cancel{21}}}{1} = \frac{49}{6}s. = 8s.\ 2d.$$

$$\frac{9}{16}s. = \frac{9}{\underset{4}{\cancel{16}}}\times\frac{\overset{3}{\cancel{12}}}{1} = \frac{27}{4}d. = 6\tfrac{3}{4}d.$$

	£	s.	d.
£2·3125 =	2	6	3
7$\frac{7}{18}$ gui. =	7	15	2
11·6875 cr. =	2	18	5¼
19$\frac{9}{16}$s. =		19	6¾
	£13	19	5

(4)...
$$\begin{array}{ccccccc}\text{da. hrs.} & & \text{da. hrs.} & & & & s.\\ 8\times9 & : & 12\times10 & :: & 30 & : & x\end{array}$$

$$x = \frac{\overset{3}{\cancel{12}}\times\overset{5}{\cancel{10}}\times\overset{10}{\cancel{30}}}{\underset{2}{\cancel{8}}\times\underset{3}{\cancel{9}}} = 50s. = £2\ 10s.$$

T 2

(5)...   No. of ranks $= 2500 \div 4 = 625$

No. of spaces between ranks $= 624$

$$\text{Length of procession} = (\overset{\text{in.}}{15} \times 625) + (\overset{\text{in.}}{42} \times 624)$$

$$= \overset{\text{in.}}{\cdot 9375} + \overset{\text{in.}}{36208}$$

$$= 35583 \text{ inches}$$

$$= 988 \text{ yds. 1 ft. 3 in.}$$

(6)...

$$\pounds 3 \cdot 86 = \pounds 3 \frac{86-8}{90} = \pounds 3 \frac{78}{90} = \pounds 3 \frac{13}{15} \text{ per oz.}$$

$$7 \cdot 583 \text{ lb.} = 7 \frac{583-58}{900} \text{ lb.} = 7 \frac{525}{900} \text{ lb.} = 7 \frac{7}{12} \text{ lb.}$$

$$\pounds 3 \tfrac{13}{15} \times 12 \times 7 \tfrac{7}{12} = \frac{58}{15} \times \frac{\cancel{12}}{1} \times \frac{91}{\cancel{12}} = \pounds \frac{5278}{15}$$

$$= \pounds 351 \tfrac{13}{15} = \pounds 351 \; 17s. \; 4d.$$

(7)...

$$\pounds \cdot 53 = \pounds \frac{53-5}{90} = \pounds \frac{48}{90} = \pounds \frac{8}{15} = 10s. \; 8d.$$

$$\begin{array}{ccc} \pounds & s. & d. \\ 0 & 10 & 8 \text{ per oz.} \\ & & 6 \times 7 + 1 = 43 \\ \hline 3 & 4 & 0 \\ & & 7 \\ \hline 22 & 8 & 0 \\ & 10 & 8 \\ & 5 & 4 \\ & & 8 \\ \hline \pounds 23 & 4 & 8 \end{array}$$

10 dwt. $= \frac{1}{2}$ of 1 oz.

1 dwt. 6 grs. $= \frac{1}{8}$ of 10 dwt.

(8)... Amount of $\pounds 100$ in $3\frac{1}{3}$ yrs. at $4\frac{1}{2}$ per cent. per annum
$= \pounds 100 + (\pounds 4\frac{1}{2} \times 3\frac{1}{3}) = \pounds 115$

$$\begin{array}{ccccccccc} \pounds & & \pounds & s. & d. & & \pounds & & \pounds & s. & d. \\ 115 & : & 202 & 4 & 2 & :: & 100 & : & 175 & 16 & 8 \end{array}$$

(9)...

$$
\begin{array}{llll}
 & \pounds & s. & d. \\
12\tfrac{1}{2} \text{ per cent.} = \tfrac{1}{8} | & 1 & 17 & 4 \\
\text{required profit} | & & 4 & 8 \\
\text{selling price} & \pounds 2 & 2 & 0 \text{ per cwt.}
\end{array}
$$

$$
1 \text{ cwt.} = 112 \left\{
\begin{array}{llll}
 & \pounds & s. & d. \\
4) & 2 & 2 & 0 \\
4) & & 10 & 6 \\
7) & & 2 & 7\tfrac{1}{2} \\
\hline
 & & & 4\tfrac{1}{2}d. \text{ per lb.}
\end{array}
\right.
$$

(10)...

$$5\sqrt{75}+2\sqrt{48}-3\sqrt{108}+6\sqrt{27}-\sqrt{192}$$

$$= 5\sqrt{25\times3}+2\sqrt{16\times3}-3\sqrt{36\times3}+6\sqrt{9\times3}-\sqrt{64\times3}$$

$$= 25\sqrt{3}+8\sqrt{3}-18\sqrt{3}+18\sqrt{3}-8\sqrt{3}$$

$$= 25\sqrt{3}$$

EXERCISE CXVIII.

$$
\begin{array}{ll}
(1)\dots 1. \ 18\text{ in.}=\tfrac{1}{2}\text{ of 1 yd.} &
\begin{array}{lll}
\pounds & s. & d. \\
0 & 3 & 6 \text{ per yard} \\
 & & 19 \\
\hline
3 & 6 & 6 \\
 & 1 & 9 \\
9\text{ in.}=\tfrac{1}{2}\text{ of 18 in.} \quad & & 10\tfrac{1}{2} \\
4\tfrac{1}{2}\ ,, \ =\tfrac{1}{2}\text{ of 9 in.} & & 5\tfrac{1}{4} \\
\hline
\pounds 3 & 9 & 6\tfrac{3}{4}
\end{array}
\end{array}
$$

$$
\begin{array}{ll}
\begin{array}{l}
\text{ft. in.} \\
2. \quad 4 \ 72 = \tfrac{1}{8}\text{ of 1 sq. yd.} \\
\\
2 \ 36 = \tfrac{1}{2}\text{ of }4\tfrac{1}{2}\text{ ft.} \\
1 \ 18 = \tfrac{1}{2}\text{ of }2\tfrac{1}{4}\text{ ft.}
\end{array}
&
\begin{array}{lll}
\pounds & s. & d. \\
1 & 10 & 0 \text{ per square yard} \\
 & 25 & \\
\hline
37 & 10 & 0 \\
 & 15 & 0 \\
 & 7 & 6 \\
 & 3 & 9 \\
\hline
\pounds 38 & 16 & 3
\end{array}
\end{array}
$$

ft. in.

3. 13 864 = ½ of 1 c. yd.

4 864 = ⅓ of 13½ ft.
972 = ⅛ of 4½ ft.

$$
\begin{array}{ccc}
£ & s. & d. \\
3 & 3 & 0 \text{ per cubic yard} \\
 & & 13 \\
\hline
40 & 19 & 0 \\
1 & 11 & 6 \\
 & 10 & 6 \\
 & 1 & 3\frac{3}{4} \\
\hline
£43 & 2 & 3\frac{3}{4}
\end{array}
$$

(2)...1.

$$\frac{5\frac{2}{5} \text{ of } 7\frac{2}{9}}{8\frac{7}{24}-3\frac{5}{12}} = \frac{\overset{3}{\cancel{27}} \times \overset{13}{\cancel{65}}}{\cancel{5} \quad 9} \Big/ \left(8\frac{7}{24}-3\frac{10}{24}\right) = \frac{39}{4\frac{21}{24}} = \frac{\cancel{39} \times \overset{8}{\cancel{24}}}{\underset{3}{\cancel{117}}} = 8$$

2. $\dfrac{1}{7\frac{1}{9}} = \dfrac{9}{64}$, $\quad \dfrac{1}{5\frac{9}{64}} = \dfrac{64}{329}$, $\quad \dfrac{1}{3\frac{64}{329}} = \dfrac{329}{1051}$

(3)...

da. hrs.   da. hrs.   s.   s.

$$6\times10 \ : \ 8\times x \ :: \ 30 \ : \ 46$$

$$x = \frac{\overset{7}{\cancel{6}} \times \cancel{10} \times \overset{23}{\cancel{46}}}{\underset{\underset{2}{4}}{\cancel{8}} \times \underset{3}{\cancel{30}}} = \frac{23}{2} \text{ hrs.} = 11\frac{1}{2} \text{ hours per day}$$

(4)...

			s.	d.		£	s.	d.
7⅝ yds.	Cloth	....	12	6	=	4	15	3¾
3 9/16	„ Silk Velvet ...		7	4	=	1	6	1¼
14¾	„ Lutestring ...		3	10	=	2	16	6¼
7½	„ Flannel.........		1	9	=	0	13	1½
26½	„ Calico		0	7½	=	0	16	6¾
16	„ Ribbon		0	5½	=	0	7	4
						10	15	0

Discount, 2½ per cent. = $\frac{1}{40}$

$$
\begin{array}{ccc}
 & 5 & 4\frac{1}{2} \\
\hline
£10 & 9 & 7\frac{1}{2}
\end{array}
$$

(5)... £6·69375 $= £6\frac{111}{160}$ 11·142857 cwt. $= 11\frac{1}{7}$ cwt.

$$\underset{3\frac{9}{14}}{\overset{\text{cwt.}}{}} \quad : \quad \underset{11\frac{1}{7}}{\overset{\text{cwt.}}{}} \quad :: \quad \underset{6\frac{111}{160}}{\overset{£}{}} \quad : \quad x$$

$$x = \frac{\cancel{14}^{\cancel{2}}}{\cancel{51}} \times \frac{78}{7} \times \frac{\cancel{1071}^{21}}{\cancel{160}_{\substack{\cancel{80}\\40}}} = £\frac{819}{40} = £20 \ 9s. \ 6d.$$

(6)... $3\frac{1}{2}$ E. ells. $= \frac{7}{2} \times \frac{5}{4} = \frac{35}{8} = 4\frac{3}{8}$ yds.

$$\underset{4\frac{3}{8}}{\overset{\text{yds.}}{}} \quad : \quad \underset{37\frac{5}{8}}{\overset{\text{yds.}}{}} \quad :: \quad \underset{1\frac{5}{16}}{\overset{£}{}} \quad : \quad x$$

$$x = \frac{\cancel{8}}{\cancel{35}_{5}} \times \frac{301}{\cancel{8}} \times \frac{\cancel{21}^{3}}{16} = £\frac{903}{80} = £11 \ 5s. \ 9d.$$

(7)...

	qrs.	bu.	pks.
	4	5	2
			17
	79	5	2
2 roods =	2	2	3
20 perches =		4	$2\frac{3}{4}$
	82	4	$3\frac{3}{4}$

(8)...

			s.	d.		£	s.	d.
64 lb.	Black Tea	......	3	2	=	10	2	8
16 „	Green „	......	4	0	=	3	4	0
80 „		cost				£13	6	8

80 lb. Mixed Tea.........$\overset{s.}{3} \ \overset{d.}{9} = £15$

Profit $= £15 - £13 \ 6s. \ 8d. = £1 \ 13s. \ 4d.$

$$\underset{13 \quad 6 \quad 8}{\overset{£ \ \ s. \ \ d.}{}} \quad : \quad \underset{1 \quad 13 \quad 4}{\overset{£ \ \ s. \ \ d.}{}} \quad :: \quad 100 \quad : \quad 12\frac{1}{2} \text{ per cent.}$$

(9)... $(\cdot 833 \ \&c.)^2 \times (\cdot 8181 \ \&c.)^2 = (\frac{5}{6})^2 \times (\frac{9}{11})^2$

$$= \frac{25}{\cancel{36}_{4}} \times \frac{\cancel{81}^{9}}{121} = \frac{225}{484}$$

(10)... $\sqrt{180} - \sqrt{320} + \sqrt{605} + \sqrt{20} - \sqrt{245}$

$$= \sqrt{36 \times 5} - \sqrt{64 \times 5} + \sqrt{121 \times 5} + \sqrt{4 \times 5} - \sqrt{49 \times 5}$$

$$= 6\sqrt{5} - 8\sqrt{5} + 11\sqrt{5} + 2\sqrt{5} - 7\sqrt{5}$$

$$= 4\sqrt{5}$$

EXERCISE CXIX.

(1)... $2s. \ 6d. = \frac{5}{21}$ of half-a-guinea

$$\frac{9}{16} \text{ hf. cr.} = \frac{9}{16} \times \frac{5}{\cancel{21}_{7}}^{3} = \frac{15}{112} \text{ of half-a-guinea}$$

$\cdot 656 = \frac{656}{1000} = \frac{82}{125}$ £1 16s. 5½d. = 1750 farthings

$$\frac{82}{\cancel{125}} \times \frac{\cancel{1750}^{14}}{1} = 1148 \text{ far.} = £1 \ 3s. \ 11d.$$

(2)... $\frac{17\frac{3}{5}}{23\frac{3}{8}} = \frac{\cancel{88}{5}}{\cancel{187}{8}} = \frac{\cancel{88}^{8} \times 8}{\cancel{187}_{17} \times 5} = \frac{64}{85}$; £10 5s. 5d. = 2465d.

$$\frac{64}{\cancel{85}} \times \frac{\cancel{2465}^{29}}{1} = 1856d. = £7 \ 14s. \ 8d.$$

(3)... The first five months of 1867 contained 151 days

$$
\begin{array}{ccccccc}
\text{da.} & & \text{da.} & & \pounds & s. & \\
365 & : & 151 & :: & 36 & 10 & : & x \\
& & & & 20 & & \\
\hline
& & & & 730 & &
\end{array}
$$

$$x = \frac{151 \times \overset{2}{\cancel{730}}}{\cancel{365}} = 302s. = \pounds 15\ 2s.$$

$$
\begin{array}{lll}
& & \pounds\quad s. \\
\text{Rent of house for the year} & & 36\ \ 10 \\
\quad\text{do.}\quad\text{for first 5 months} & & 15\ \ \ 2 \\
\quad\text{do.}\quad\text{for remainder of year} & & \overline{21\ \ \ 8}
\end{array}
$$

(4)... $\pounds 4\ 9s.\ 3d. = \pounds 4\frac{37}{80}$; $13\frac{1}{2}$ gui. $= \pounds 14\frac{7}{40}$

$$
\begin{array}{ccccccc}
\pounds & & \pounds & & \text{yds.} & & \\
4\frac{37}{80} & : & 14\frac{7}{40} & :: & 19\frac{5}{8} & : & x
\end{array}
$$

$$x = \frac{\cancel{80}}{\cancel{357}} \times \frac{\overset{\overset{63}{\cancel{189}}}{\cancel{567}}}{\cancel{40}} \times \frac{\cancel{119}}{\cancel{8}} = 63 \text{ yards}$$

$$
\begin{array}{ccccccccccc}
\text{men} & \text{da.} & \text{hrs.} & & \text{men} & \text{da.} & \text{hrs.} & & \text{yds.} & \text{yds.} & & \text{yds.} & \text{yds.}
\end{array}
$$

(5)... $4 \times 3 \times 10\frac{1}{2}\ :\ 3 \times 5 \times x\ ::\ 189 \times 160\ :\ 275 \times 144$

$$x = \frac{4 \times 3 \times 10\frac{1}{2} \times 275 \times 144}{3 \times 5 \times 189 \times 160} = 11 \text{ hours}$$

(6)...

$$
\begin{array}{ccccccc}
\pounds & & \pounds & & \pounds & & \\
71\frac{3}{4} & : & 2500 & :: & 3\frac{1}{2} & : & x \\
4 & & & & 4 & & \\
\hline
287 & & & & 14 & &
\end{array}
$$

$$x = \frac{2500 \times \overset{2}{\cancel{14}}}{\underset{41}{\cancel{287}}} = \pounds\frac{5000}{41} = \pounds 121\ 19s.\ 0\frac{12}{41}d.$$

(7)...　　Cost of £100 stock $= £73\frac{5}{8}+2s.\ 6d. = £73\frac{3}{4}$

$$\begin{array}{ccccccc}
£ & & £ & & £ & & \\
73\frac{3}{4} & : & 4144\frac{3}{4} & :: & 100 & : & x \\
4 & & 4 & & & & \\
\hline
295 & & 16579 & & & &
\end{array}$$

$$x = \frac{\overset{281}{\cancel{16579}} \times \overset{20}{\cancel{100}}}{\underset{59}{\cancel{295}}} = £5620$$

(8)...　　　$\cdot357357\ \&c. = \frac{357}{999} = \frac{119}{333}$

$$\cdot357373\ \&c. = \frac{3573-35}{9900} = \frac{3538}{9900} = \frac{1769}{4950}$$

(9)...

$$
\begin{array}{l}
65711220964(256342 \\
\quad\ 4 \\
45)\overline{257} \\
\quad\ 225 \\
506)\ \overline{3211} \\
\quad\ 3036 \\
5123)\ \overline{17522} \\
\quad\ 15369 \\
51264)\ \overline{215309} \\
\quad\ 205056 \\
512682)\ \overline{1025364} \\
\quad\ 1025364 \\
\hline
\end{array}
$$

$$\sqrt{141\tfrac{55}{289}} = \sqrt{\tfrac{40804}{289}} = \tfrac{202}{17} = 11\tfrac{15}{17}$$

(10)...　　　$52542\frac{1126}{1331} = \frac{69934528}{1331}$

$$\sqrt[3]{\frac{69934528}{1331}} = \frac{412}{11} = 37\frac{5}{11}$$

EXERCISE CXX.

(1)...From 10.10 P.M. January 6th to 1.13 P.M. January 7th
= 15 hours 3 minutes

$$
\begin{array}{ccccc}
\text{hrs.} & \text{min.} & \text{hr.} & \text{miles} \\
15 & 3 & : & 1 & :: & 515 & : & x \\
& 60 & & 60 \\
\hline
& 903 & & 60
\end{array}
$$

$$
x = \frac{\overset{20}{\cancel{60}} \times 515}{\underset{301}{\cancel{903}}} = \frac{10300}{301} \text{ mi.} = 34\tfrac{66}{301} \text{ miles}
$$

(2)...

$$
\begin{array}{cccccc}
\text{hrs.} & \text{min.} & \text{hrs.} & \text{hr.} & \text{miles} \\
2 & 25 = 2\tfrac{5}{12} & : & 1 & :: & 130\tfrac{1}{2} & : & x
\end{array}
$$

$$
x = \frac{\overset{6}{\cancel{12}}}{\cancel{29}} \times \frac{\overset{9}{\cancel{261}}}{\cancel{2}} = 54 \text{ miles}
$$

(3)...

$$
\frac{11}{18} \text{ gui.} = \frac{11}{\underset{6}{\cancel{18}}} \times \frac{\overset{7}{\cancel{21}}}{1} = \frac{77}{6} = \quad \begin{array}{cc} s. & d. \\ 12 & 10 \end{array}
$$

$$
\frac{13}{32} \text{ sov.} = \frac{13}{\underset{8}{\cancel{32}}} \times \frac{\overset{5}{\cancel{20}}}{1} = \frac{65}{8} = \quad 8 \quad 1\tfrac{1}{2}
$$

$$
\frac{9}{20} \text{ cr.} = \frac{9}{\underset{4}{\cancel{20}}} \times \frac{\cancel{5}}{1} = \frac{9}{4} = \quad 2 \quad 3
$$

$$
\frac{7}{24} = \qquad\qquad 3\tfrac{1}{2}
$$

$$
\overline{\qquad \pounds 1 \quad 3 \quad 6}
$$

$$
\begin{array}{l}
 d. \\
12)\overline{6} \\
20)\overline{3{\cdot}5} \\
5)\overline{1{\cdot}175}
\end{array}
$$

£1 3s. 6d. = ·235 of £5

(4)... $\qquad$ 4·96875 cwt. × 7 = 34·78125 cwt.

$$
\begin{array}{ccc}
\text{cwt.} & \text{cwt.} & \pounds \\
\cancel{5\cdot 65625} : & 34\cdot 78125 & :: \quad \cancel{11\cdot 878125} \\
& 2\cdot 1 & \qquad 2\cdot 1 \\
\hline
& 3478125 & \\
\bullet \quad & 6956250 & \\
\hline
\end{array}
$$

$$\pounds\overline{73\cdot 040625} = \pounds73 \; 0s. \; 9\tfrac{3}{4}d.$$

$$
\begin{array}{l}
\underline{20} \\
0\cdot 812500s. \\
\underline{12} \\
9\cdot 750000d. \\
\underline{4} \\
3\cdot 000000 \text{ far.}
\end{array}
$$

$$
\begin{array}{l}
\text{men wks. hrs.} \qquad \text{men wks. hrs.} \qquad \text{mi. yds. ft.} \quad \text{mi. yds. ft.}
\end{array}
$$

(5)... $200 \times 22 \times 12 \;:\; 350 \times x \times 10 \;::\; 7\tfrac{1}{2} \times 12 \times 6 \;:\; 25 \times 15 \times 7$

$$
x = \frac{\overset{4}{\cancel{200}} \times \overset{11}{\cancel{22}} \times \cancel{12} \times \overset{5}{\cancel{25}} \times \cancel{15} \times \overset{7}{\cancel{7}}}{\underset{7}{\cancel{350}} \times \underset{7}{\cancel{10}} \times 7\tfrac{1}{2} \times \cancel{12} \times \underset{3}{\cancel{6}}} = \frac{220}{3} \text{ wks.} = 73\tfrac{1}{3} \text{ weeks}
$$

$$
\begin{array}{cccc}
& & \pounds & s. \quad d. \\
\end{array}
$$

(6)... $\qquad$
70 lb. at 2s. 10d. per lb. = $\quad$ 9 $\;$ 18 $\;$ 4

$\qquad\quad$ 85 lb. at 3s. 2d. $\qquad$ „ $\quad$ = 13 $\;\;$ 9 $\;$ 2

$\qquad\quad \overline{155}$ lb. $\qquad\qquad\qquad$ cost $\pounds\overline{23 \;\; 7 \;\; 6}$

155 lb. at 3s. 6d. per lb. = $\pounds$27 2s. 6d.

$\pounds$27 2s. 6d. — $\pounds$23 7s. 6d. = $\pounds$3 15s. gain

$$
\begin{array}{cccccccc}
\pounds & s. & d. & & \pounds & s. & & \pounds \\
23 & 7 & 6 & : & 3 & 15 & :: & 100 \quad : \quad 16\tfrac{8}{187} \text{ per cent.}
\end{array}
$$

(7)... From March 14th, 1860, to August 7th, 1863 = 1241 da.

$$
\begin{array}{r}
\text{£} \quad s. \quad d. \\
\text{4 per cent.} = \tfrac{1}{25} \Big| 478 \quad 15 \quad 0 \\
\tfrac{1}{2} \quad \text{,,} \quad = \tfrac{1}{8} \Big| \ 19 \quad \ 3 \quad 0 \\
2 \quad \ 7 \ 10\tfrac{1}{2} \\
\hline
\text{£}21 \quad 10 \ 10\tfrac{1}{2} \ \text{int. for 1 year}
\end{array}
$$

$$
\begin{array}{ccccc}
\text{da.} & & \text{da.} & & \text{£} \quad s. \quad d. \\
\cancel{365} & : & \cancel{1241} & :: & 21 \quad 10 \ 10\tfrac{1}{2} \\
5 & & 17 & & 17 \\
& & & & \overline{5)366 \quad 4 \ 10\tfrac{1}{2}} \\
& & & & \text{£}73 \quad 4 \ 11\tfrac{7}{10}
\end{array}
$$

(8)...Amount of £100 in 1 year at $3\tfrac{1}{4}$ per cent. = £103 5s.

$$
\begin{array}{ccccccc}
\text{£} \quad s. & & \text{£} \quad s. \quad d. & & \text{£} & & \text{£} \\
103 \quad 5 & : & 376 \quad 17 \quad 3 & :: & 100 & : & 365
\end{array}
$$

$$
\begin{array}{ll}
\text{£} \quad s. \quad d. & \\
\text{(9)...5 per cent.} = \tfrac{1}{20} \Big| 325 \quad 0 \quad 0 & \text{principal} \\
16 \quad 5 \quad 0 & \text{int. for 1st year} \\
\hline
\text{,,} \quad\quad \text{,,} \quad\quad \text{,,} \Big| 341 \quad 5 \quad 0 & \text{amount at end of 1st year} \\
17 \quad 1 \quad 3 & \text{int. for 2nd year} \\
\hline
\text{,,} \quad\quad \text{,,} \quad\quad \text{,,} \Big| 358 \quad 6 \quad 3 & \text{amount at end of 2nd year} \\
17 \quad 18 \quad 3\tfrac{3}{4} & \text{int. for 3rd year} \\
\hline
\text{,,} \quad\quad \text{,,} \quad\quad \text{,,} \Big| 376 \quad 4 \quad 6\tfrac{3}{4} & \text{amount at end of 3rd year} \\
18 \quad 16 \quad 2\tfrac{59}{80} & \text{int. for 4th year} \\
\hline
\text{£}395 \quad 0 \quad 9\tfrac{39}{80} & \text{amount in 4 years}
\end{array}
$$

(10)...

$$5 + 3\sqrt{7} = 5 + (2{\cdot}64575131 \times 3)$$

$$= 5 + 7{\cdot}93725393$$

$$= 12{\cdot}93725393$$

$$\sqrt{5 + 3\sqrt{7}} = 3{\cdot}5968\ldots\ldots$$

EXERCISE CXXI.

(1)... 1. $13\frac{5}{13}$: $29\frac{7}{9}$ :: 145 : x

$$x = \frac{13}{\cancel{174}} \times \frac{\cancel{268}}{9} \times \frac{\cancel{145}}{1} = \frac{8710}{27} = 322\frac{16}{17}$$

2. $46\frac{2}{7}$: $13\frac{10}{11}$ :: x : $8\frac{1}{2}$

$$x = \frac{\cancel{324}}{7} \times \frac{\cancel{17}}{\cancel{2}} \times \frac{11}{\cancel{153}} = \frac{198}{7} = 28\frac{2}{7}$$

3. $\cdot 065$: x :: $2 \cdot 34$: $33 \cdot 732$

   $x = (\cdot 065 \times 33 \cdot 732) \div 2 \cdot 34$

     $= 2 \cdot 19258 \div 2 \cdot 34$

     $= \cdot 937$

4. x : $7 \cdot 089$ :: $6 \cdot 8595$: $5 \cdot 31675$

   $x = (7 \cdot 089 \times 6 \cdot 8595) \div 5 \cdot 31675$

     $= 48 \cdot 6269955 \div 5 \cdot 31675$

     $= 9 \cdot 146$

(2)...   Weight of paper consumed in each week
     $= \pounds 120 \div 1\frac{1}{2}d. = 19200$ lb.

   Weight of each copy $= 19200$ lb. $\div 100000$

             $= 307200$ oz. $\div 100000$

             $= 3$ oz. $1\frac{19}{125}$ dr.

(3)... $\pounds 30$ $12s.$ $6d. = 7350$ pence

       $7350 \div 7 = \pounds 1050$ **annual income**

(4)... £158 11s. 5d. = 152228 farthings

1 sov., 1 hf. sov., 1 cr., 1 hf. cr., 1 flo., 1 sh., 1 sixp., 1 fourp.,
1 threep., 1 penny, 1 hf. penny, 1 far. = £2 1s. $8\frac{3}{4}d.$
= 2003 farthings

152228÷2003 = 76 of each coin

(5)... $\qquad 29\frac{5}{8} = 29\cdot625 \qquad\qquad 7\cdot025 = 7\frac{1}{40}$

$$29\frac{5}{8}\times7\frac{1}{40} = \frac{237}{8}\times\frac{281}{40} = \frac{66597}{320} = 208\frac{37}{320}$$

$$\begin{array}{r} 29\cdot625 \\ 7\cdot025 \\ \hline 148125 \\ 59250 \\ 207375 \\ \hline 208\cdot115625 \end{array}$$

$240\cdot65625 = 240\frac{21}{32} \qquad 47\frac{3}{16} = 47\cdot1875$

$$240\frac{21}{32}\div47\frac{3}{16} = \frac{\overset{51}{\cancel{7701}}}{\underset{2}{\cancel{32}}}\times\frac{\cancel{16}}{\underset{5}{\cancel{755}}} = \frac{51}{10} = 5\frac{1}{10}$$

$$47\cdot1875)240\cdot65625(5\cdot1$$
$$\begin{array}{r} 2359375 \\ \hline 471875 \\ 471875 \\ \hline \end{array}$$

(6)...

	£	s.	yrs.		£	s.	d.	yrs.		£	s.		
	376	15	×4	:	642	13	4	×5½	::	75	7	:	x
	20		2		20			2		20			
	7535		8		12853			11		1507			
	12				12								
	90420				154240								

$$x = \frac{\cancel{154240}\times11\times\cancel{1507}}{\cancel{90420}\times\cancel{8}} = \frac{10604}{3}s. = £176\ 14s.\ 8d.$$

(7)...   20 cwt. 1 qr. Avoird. = 15876000 grains

$$5\tfrac{1}{4} \text{ lb. Troy} = 30240 \text{ grains}$$

$$15876000 \div 30240 = 525 \text{ parcels}$$

(8)...See "*Answers.*"

(9)...   From March 19 to October 24 = 219 days

$$
\begin{array}{cccc}
 & \pounds & s. & d. \\
4 \text{ per cent.} = \tfrac{1}{25})380 & 4 & 2 \\
\hline
\pounds 15 & 4 & 2 & \text{int. for 1 year}
\end{array}
$$

$$
\begin{array}{ccccc}
da. & da. & & \pounds & s. & d. \\
\cancel{365} & \cancel{219} & :: & 15 & 4 & 2 \\
5 & 3 & & & & 3 \\
\hline
 & & 5)45 & 12 & 6 \\
\hline
 & & \pounds 9 & 2 & 6
\end{array}
$$

(10)...Amount of £100 in 9 months at 5 per cent. per annum
= £100 + (£5 × ¾) = £103 15s.

$$
\begin{array}{ccccccc}
\pounds & s. & & \pounds & s. & & \pounds & & \pounds & s. & d. \\
103 & 15 & : & 157 & 10 & :: & 100 & : & 151 & 16 & 1\tfrac{61}{83}
\end{array}
$$

EXERCISE CXXII.

(1)...

			s.	d.	£	s.	d.
13¾ yds.	Cloth	......	9	6	= 6	10	7½
17	„	Linen ...	2	3	= 1	18	3
19	„	Flannel...	1	8	= 1	11	8
10¾	„	Muslin ...	1	4	=	14	4
33	„	Calico ...	5½	=		15	1½
					11	10	0

Discount, 2½ per cent. = $\tfrac{1}{40}$ 5   9

£11   4   3

(2)... $\sqrt{5\tfrac{4}{9}} \times \sqrt[3]{12\tfrac{19}{27}} = \tfrac{7}{3} \times \tfrac{7}{3} = \tfrac{49}{9} = 5\tfrac{4}{9}$

(3)...$\quad \dfrac{19}{56}$ gui. $= \dfrac{19}{\cancel{56}} \times \dfrac{\overset{3}{\cancel{21}}}{1} = \dfrac{57}{8}s. = 7s.\ 1\tfrac{1}{2}d.$

$$\dfrac{8}$$

$$
\begin{array}{l}
\cdot 171875 \text{ of } \pounds 5 = 17s.\ 2\tfrac{1}{4}d.\\
\underline{5}\\
\cdot 859375 \text{ of } \pounds 1\\
\underline{20}\\
17\cdot 187500s.\\
\underline{12}\\
2\cdot 250000d.\\
\underline{4}\\
1\cdot 000000 \text{ far.}
\end{array}
$$

$$17s.\ 2\tfrac{1}{4}d. - 7s.\ 1\tfrac{1}{2}d. = 10s.\ 0\tfrac{3}{4}d.$$

(4)...
$$
\begin{array}{l}
\text{min.}\\
60)\,30\\
24)\overline{19\cdot 5}\\
7)\ \overline{4\cdot 8125}
\end{array}
$$

4 da. 19 ho. 30 min. $= \cdot 6875$ of a week

(5)...$\quad \cdot 47575\ \&c. = \dfrac{475-4}{990} = \dfrac{471}{990} = \dfrac{157}{330}$

$\cdot 73636\ \&c. = \dfrac{736-7}{990} = \dfrac{729}{990} = \dfrac{81}{110}$

$\dfrac{81}{110} - \dfrac{157}{330} = \dfrac{243-157}{330} = \dfrac{86}{330} = \dfrac{43}{165} = \cdot 26060\ \&c.$

(6)...$\quad 2\tfrac{1}{8}$ yds. $+ \tfrac{11}{16}$ yd. $+ 1\tfrac{1}{4}$ yd. $= 4\tfrac{1}{16}$ yds.

$32\tfrac{1}{2}$ yds. $+ 4\tfrac{1}{16}$ yds. $= 8$ suits

(7)...
$$
\begin{array}{cccc}
\text{re. da. ho.} & \text{re. da. ho.} & \text{yds. yds} & \text{yds. yds.}\\
6\times 5\times 10 & :\ 5\times 8\times x & ::\ 300\times 242 & :\ 484\times 220
\end{array}
$$

$$x = \dfrac{\cancel{6}\times \cancel{5}\times \overset{11}{\cancel{10}}\times \cancel{484}\times \cancel{220}}{\cancel{5}\times \cancel{8}\times \cancel{300}\times \cancel{242}} = 11 \text{ hours}$$

U

(8)...From noon on Monday to 6 A.M. on Friday = 90 hours

The clock marks 24 hours 5 minutes in 24 hours

$$
\begin{array}{ccccccc}
\text{ho.} & \text{min.} & & \text{ho.} & & \text{ho.} & \\
24 & 5 & : & 90 & :: & 24 & : & x \\
& 60 & & 60 & & & \\
\hline
& 1445 & & 5400 & & &
\end{array}
$$

$$
x = \frac{\cancel{5400} \times 24}{\cancel{1445}} = \frac{25920}{289} \text{ hrs.} = 89 \text{ hrs. } 41\tfrac{91}{289} \text{ min.}
$$

∴ when the hands point to 6 on Friday morning, the correct time is 5 hours $41\tfrac{91}{289}$ min.

(9)...
$$
\frac{3}{10} + \frac{7}{50} + \frac{9}{25} = \frac{15+7+18}{50} = \frac{40}{50} = \frac{4}{5}
$$

$$
1 - \tfrac{4}{5} = \tfrac{1}{5} = 250 \text{ persons}
$$

Total number of persons = 1250

			s.	d.	£	s.
$\frac{3}{10}$ of 1250 = 375 at	5	0	=	93	15	
$\frac{7}{50}$ of 1250 = 175 at	4	0	=	35	0	
$\frac{9}{25}$ of 1250 = 450 at	2	6	=	56	5	
$\frac{1}{5}$ of 1250 = 250 at	1	0	=	12	10	

Total receipts = £197 10s.

(10)...
$$
\sqrt{171\tfrac{1}{169}} = \sqrt{\tfrac{28900}{169}} = \tfrac{170}{13} = 13\tfrac{1}{13}
$$

$$
\sqrt[3]{405\tfrac{28}{125}} = \sqrt[3]{\tfrac{50653}{125}} = \tfrac{37}{5} = 7\tfrac{2}{5}
$$

EXERCISE CXXIII.

(1)...

1. $\dfrac{5\frac{3}{10}+7\frac{4}{5}}{12\frac{3}{8}-7\frac{1}{2}} = \dfrac{5\frac{3}{10}+7\frac{8}{10}}{12\frac{3}{8}-7\frac{4}{8}} = \dfrac{13\frac{1}{10}}{4\frac{7}{8}} = \dfrac{\frac{131}{10}}{\frac{39}{8}}$

$= \dfrac{131 \times \overset{4}{\cancel{8}}}{39 \times \underset{5}{\cancel{10}}} = \dfrac{524}{195} = 2\frac{134}{195}$

2. $\dfrac{3\frac{5}{7}\times2\frac{4}{5}\times3\frac{1}{3}}{3\frac{5}{8}\times1\frac{5}{8}\times1\frac{1}{2}} = \dfrac{\frac{104}{3}}{\frac{26}{3}} = \dfrac{104}{26} = 4$

3. $\dfrac{\frac{2}{5}\text{ of }\frac{7}{10}}{9\frac{1}{3}}\times\dfrac{2\frac{1}{7}}{8\frac{5}{14}}\times\dfrac{5\frac{1}{3}-2\frac{1}{5}}{3\frac{1}{13}}\times\dfrac{62\frac{1}{2}}{1\frac{4}{5}+1\frac{1}{3}}$

$= \dfrac{\frac{7}{25}}{\frac{28}{3}}\times\dfrac{\frac{15}{7}}{\frac{117}{14}}\times\dfrac{\frac{47}{15}}{\frac{40}{13}}\times\dfrac{\frac{125}{2}}{\frac{47}{15}}$

$= \dfrac{\cancel{3}}{\underset{4}{\cancel{100}}}\times\dfrac{\overset{5}{\cancel{10}}}{\underset{3}{\cancel{39}}}\times\dfrac{\overset{13}{\cancel{611}}}{\underset{8}{\cancel{600}}}\times\dfrac{\overset{25}{\cancel{1875}}}{\underset{2}{\cancel{94}}}$

$= \dfrac{5}{32}$

(2)... 2 wks. 4 da. 19 hrs. 32 min. = 27092 minutes
1 month = 40320 „

$\frac{27092}{40320}\div\frac{4}{4} = \frac{6773}{10080}$ of a month

37 wks. 3 da. 18 hrs. = 6306 hours
365 da. 6 hrs. = 8766 „

$\frac{6306}{8766}\div\frac{6}{6} = \frac{1051}{1461}$ of a year

(3)... $\quad$ gui. $\qquad\qquad\qquad\qquad$ sov.

$\cdot7356 = 15s.\ 5\frac{232}{625}d.$ $\qquad\qquad$ $\cdot89545 = 17s.\ 10\frac{227}{250}d.$

$\qquad\quad$ 21 $\qquad\qquad\qquad\qquad\qquad\qquad$ 20

$\quad\overline{15\cdot4476s.}$ $\qquad\qquad\qquad\qquad$ $\overline{17\cdot90900s.}$

$\qquad\quad$ 12 $\qquad\qquad\qquad\qquad\qquad\qquad$ 12

$\quad\overline{5\cdot3712d.}$ $\qquad\qquad\qquad\qquad$ $\overline{10\cdot90800d.}$

$$
\begin{array}{cc}
s. & d. \\
17 & 10\frac{227}{250} \\
15 & 5\frac{232}{625} \\
\hline
2 & 5\frac{671}{1250}
\end{array}
$$

(4)...2·83 ft.=2⅚ ft.   43·61 ft.=43$\frac{11}{18}$ ft.   19·83 ft.=19⅚ ft.

Area of floor $= 43\frac{11}{18}$ ft. $\times 19\frac{5}{6}$ ft.

Area of 1 yd. of matting $= 2\frac{5}{6}$ ft. $\times 3$ ft.

No. of yards of matting required

$$= (43\tfrac{11}{18}\times19\tfrac{5}{6})\div(2\tfrac{5}{6}\times3)$$

$$= \frac{785}{18}\times\frac{\cancel{119}^{\,7}}{\cancel{6}}\times\frac{\cancel{6}}{\cancel{17}}\times\frac{1}{3}$$

$$= \tfrac{5494}{54}\text{yds.}=101\tfrac{44}{54}\text{yds.}=101\text{ yds. 2 ft. }3\tfrac{1}{3}\text{ in.}$$

(5)...   The trains approach each other at the rate of

$\qquad$ (23¾+27½ =) 51¼ miles per hour

hence they will meet in 112½÷51¼ = $\frac{90}{41}$ hours

∴ at the time of meeting the one train will be

$\qquad$ 23¾×$\frac{90}{41}$ = 52$\frac{11}{82}$ miles from London

and the other 27½×$\frac{90}{41}$ = 60$\frac{15}{41}$ miles from Birmingham

(6)...

$$
\begin{array}{ccc}
£ & s. & d. \\
341 & 1 & 7\frac{1}{4} \\
291 & 16 & 8 \\
\hline
£49 & 4 & 11\frac{1}{4}
\end{array}
$$

interest in 4½ years

£49 4s. 11¼d.÷4½ = £10 18s. 10½d. interest for 1 year

$$
\begin{array}{ccccccccc}
£ & s. & d. & & £ & & £ & s. & d. & & £ \\
291 & 16 & 8 & : & 100 & :: & 10 & 18 & 10\frac{1}{2} & : & 3\frac{3}{4}\text{ per cent.}
\end{array}
$$

(7)...

$$
\begin{array}{r}
\phantom{78 \text{ gui.} = }\poundss. \\
78 \text{ gui.} = 81 \quad 18 \text{ amount} \\
65 \quad ,, = 68 \quad 5 \text{ principal} \\
\hline
\pounds 13 \quad 13 \text{ interest}
\end{array}
$$

$$
\begin{array}{l}
\phantom{2\tfrac{1}{2}\text{ per cent.}=}\poundss.d. \\
2\tfrac{1}{2} \text{ per cent.} = \tfrac{1}{40} \Big| 68 \quad 5 \quad 0 \\
1\tfrac{1}{4} ,, = \tfrac{1}{2} \Big| \begin{array}{ccc} 1 & 14 & 1\tfrac{1}{2} \\ 0 & 17 & 0\tfrac{3}{4} \end{array} \\
\hline
\pounds 2 \quad 11 \quad 2\tfrac{1}{4} \text{ interest for 1 year}
\end{array}
$$

$$
\begin{array}{ccccccc}
\pounds\; s.\; d. & & \pounds\; s. & & \text{yr.} & & \text{yrs.} \\
2\; 11\; 2\tfrac{1}{4} & : & 13\; 13 & :: & 1 & : & 5\tfrac{1}{3} = 5 \text{ yrs. 4 mo.}
\end{array}
$$

(8)...

$$
\begin{array}{ccccccc}
\pounds & & \pounds & & \pounds & & \\
77\tfrac{1}{2} & : & 1750 & :: & 3\tfrac{1}{2} & : & x \\
2 & & & & 2 & & \\
\hline
155 & & & & 7 & &
\end{array}
$$

$$
x = \frac{\overset{350}{\cancel{1750}} \times 7}{\underset{31}{\cancel{155}}} = \pounds\frac{2450}{31} = \pounds 79 \; 0s. \; 7\tfrac{23}{31}d.
$$

(9)...

$$
17\sqrt{48} - 11\sqrt{75} + 19\sqrt{192} - 7\sqrt{108}
$$

$$
= 17\sqrt{16 \times 3} - 11\sqrt{25 \times 3} + 19\sqrt{64 \times 3} - 7\sqrt{36 \times 3}
$$

$$
= 68\sqrt{3} - 55\sqrt{3} + 152\sqrt{3} - 42\sqrt{3}
$$

$$
= 123\sqrt{3}
$$

(10)...

$$
\frac{\sqrt{10 + \sqrt[3]{1331} + \sqrt{225}}}{\sqrt{9 + \sqrt[3]{729} + \sqrt{961}}} = \frac{\sqrt{10 + 11 + 15}}{\sqrt{9 + 9 + 31}} = \frac{\sqrt{36}}{\sqrt{49}} = \frac{6}{7}
$$

EXERCISE CXXIV

(1)... Perimeter of ground $= (136\tfrac{1}{2} + 97\tfrac{1}{2}) \times 2 = 468$ yards

      length of each hurdle $= 6$ ft. 6 in. $= 2\tfrac{1}{6}$ yards

No. of hurdles $= 468 \div 2\tfrac{1}{6} = \dfrac{\cancel{468}^{36}}{1} \times \dfrac{6}{\cancel{13}} = 216 = 18$ dozen

$$
\begin{array}{lccc}
 & \pounds & s. & d. \\
\text{18 doz. hurdles at } 13s.\ 6d.\text{ per doz.} = & 12 & 8 & 0 \\
 & & 17 & 6 \\ \hline
\text{total expense} = & \pounds 13 & 0 & 6 \\
\end{array}
$$

(2)...   At the time of their meeting A has walked

       $(\tfrac{1}{20} \times 3\tfrac{1}{3} =)\tfrac{1}{6}$ of a mile more than B

$(28 - \tfrac{1}{6}) \div 2 = 13\tfrac{11}{12}$ miles, the distance B has walked

$13\tfrac{11}{12} + \tfrac{1}{6} = 14\tfrac{1}{12}$ miles, the distance A has walked

hence A's rate of walking $= 14\tfrac{1}{12} \div 3\tfrac{1}{3} = 4\tfrac{9}{20}$ miles per hour

and B's   ,,   ,, $= 13\tfrac{11}{12} \div 3\tfrac{1}{3} = 4\tfrac{7}{20}$,,   ,,

(3)...

$$
\begin{array}{ccccccc}
\text{per. da.} & d. & & \text{per. da.} & d. & & \pounds & s. & d. \\
9 \times 30 \times 7\tfrac{1}{2} & : & & 13 \times 123 \times 8\tfrac{1}{2} & :: & & 5 & 12 & 6 & : & x \\
\end{array}
$$

$$
\begin{array}{ccc}
\dfrac{2}{15} & \dfrac{2}{17} & \begin{array}{r} 20 \\ \hline 112 \\ 12 \\ \hline 1350 \end{array}
\end{array}
$$

$$
x = \frac{13 \times \cancel{123}^{41} \times 17 \times \cancel{1350}^{\cancel{45}^{3}}}{\cancel{9} \times \cancel{30} \times \cancel{15}} = 9061d. = \pounds37\ 15s.\ 1d.
$$

(4)...   From May 10th to Oct. 17th = 160 days

$$
\begin{array}{ll}
 & \text{cows} \quad \text{da.} \\
\text{A} & 7 \times 160 = 1120 \\
\text{B} & 9 \times 120 = 1080 \\
\text{C} & 8 \times \;90 = \;\;720 \\
\hline
 & \qquad\qquad 2920
\end{array}
$$

2920 : 1120 :: £18 5s. : £7 A's share

2920 : 1080 :: £18 5s. : £6 15s. B's share

2920 : 720 :: £18 5s. : £4 10s. C's share

(5)... $14\frac{1}{2} \times 1\frac{1}{4} \times \frac{7}{8} = \frac{29}{2} \times \frac{5}{4} \times \frac{7}{8} = \frac{1015}{64}$ cubic feet

1s. 8d. $= \frac{1}{12}$ of £1

$£\frac{1}{12} \times \frac{1015}{64} = £\frac{1015}{768} = £1$ 6s. $5\frac{3}{16}d.$

(6)...

ac.	per.		ac. ro. per.		per.		s. d.		d.	

1=160 : 373 2 16=59776 :: 37 6 = 450 : x

$$x = \frac{\overset{3736}{\cancel{59776}} \times \overset{45}{\cancel{450}}}{\underset{\cancel{16}}{\cancel{160}}} = 168120d. = £700\ 10s.$$

10 per cent. $= \frac{1}{10}$) $\overset{£\quad s.}{700\ \ 10}$ annual rent of farm

$\overline{£70\ \ 1s.}$

(7)... $4 : 4\frac{1}{4} ::$

$$
\begin{array}{rrr}
£ & s. & d. \\
762 & 0 & 0 \\
 & & 4\frac{1}{4} \\
\hline
3048 & 0 & 0 \\
190 & 10 & 0 \\
\hline
4) 3238 & 10 & 0 \\
\hline
£809 & 12 & 6 \\
\end{array}
$$

(8)...   7 for sixpence = $10\frac{2}{7}d$. per dozen

                  gain = $2\frac{2}{7}d$.   „

$$\begin{array}{ccccccc} d. & & d. & & & & \\ 8 & : & 2\frac{2}{7} & :: & 100 & : & 28\frac{4}{7} \text{ per cent.} \end{array}$$

$$\begin{array}{lcr} & & £ \quad s. \\ 42 \text{ dozen at 7 for sixpence} = & & 1 \quad 16 \\ 42 \quad \text{„} \quad \text{„} \quad 8d. \text{ per dozen} = & & 1 \quad 8 \\ \text{profit} = & & \overline{ 8s.} \end{array}$$

(9)...   £6 6s. 9d. = 6084 farthings

$\sqrt{6084}$ = 78 = No. of lb.

price per lb. = 78 farthings = $1s. \, 7\frac{1}{2}d.$

$$\begin{array}{lllll} & £ & s. & d. & \\ (10)...5 \text{ per cent.} = \frac{1}{20} | 1500 & 0 & 0 & \text{principal} \\ \phantom{(10)...5 \text{ per cent.}} 75 & 0 & 0 & \text{int. for 1st year} \\ \text{„} \quad\quad \text{„} \quad | \overline{1575} & 0 & 0 & \text{amount at end of 1st year} \\ 78 & 15 & 0 & \text{int. for 2nd year} \\ \text{„} \quad\quad \text{„} \quad | \overline{1653} & 15 & 0 & \text{amount at end of 2nd year} \\ 82 & 13 & 9 & \text{int. for 3rd year} \\ \text{„} \quad\quad \text{„} \quad | \overline{1736} & 8 & 9 & \text{amount at end of 3rd year} \\ 86 & 16 & 5\frac{1}{4} & \text{int. for 4th year} \\ \overline{£1823} & 5 & 2\frac{1}{4} & \text{amount in 4 years} \end{array}$$

EXERCISE CXXV.

$$\begin{array}{lccc} & & s. & d. \\ (1)... \quad\quad\quad 1. & & 16 & 8 \text{ per ell} \\ & & 6 \times 6 + 1 & = 37 \\ & & \overline{5 \quad 0} & 0 \\ & & & 6 \\ & & \overline{|30 \quad 0} & 0 \\ 2 \text{ qrs. 2 na.} = \frac{1}{2} \text{ of 1 ell} & & 16 & 8 \\ 1 \text{ qr. 1 na.} = \frac{1}{2} \text{ of } 2\frac{1}{2} \text{ qrs.} & & 8 & 4 \\ 2\frac{1}{2} \text{ na.} = \frac{1}{2} \text{ of } 1\frac{1}{4} \text{ qr.} & & 4 & 2 \\ & & 2 & 1 \\ & & £31 \quad \overline{11} & 3 \end{array}$$

$$
\begin{array}{llll}
 & \pounds & s. & d. \\
2. & 3 & 2 & 0 \text{ per quarter}
\end{array}
$$

$$5 \times 10 + 3 = 53$$

$$
\begin{array}{rrr}
15 & 10 & 0 \\
& & 10
\end{array}
$$

$$
\begin{array}{lllll}
 & & 155 & 0 & 0 \\
4 \text{ bu.} = \frac{1}{6} \text{ of 3 qrs.} & & 9 & 6 & 0 \\
1 \text{ bu.} = \frac{1}{4} \text{ of 4 bu.} & & 1 & 11 & 0 \\
2 \text{ pks.} = \frac{1}{2} \text{ of 1 bu.} & & & 7 & 9 \\
1 \text{ gal.} = \frac{1}{4} \text{ of 2 pks.} & & & 3 & 10\frac{1}{2} \\
 & & & & 11\frac{5}{8} \\
 & \pounds166 & 9 & & 7\frac{1}{8}
\end{array}
$$

$$
\begin{array}{llll}
 & & s. & d. \\
3. \quad 10 \text{ cwt.} = \tfrac{1}{2} \text{ of 1 ton} & & 12 & 6 \text{ per ton} \\
 & & & 19
\end{array}
$$

$$
\begin{array}{lll}
 & 11 & 17 & 6 \\
2\frac{1}{2} \text{ cwt.} = \frac{1}{4} \text{ of 10 cwt.} & 6 & 3 \\
1 \text{ cwt.} = \frac{1}{10} \text{ of 10 cwt.} & 1 & 6\frac{3}{4} \\
 & & 7\frac{1}{2} \\
\pounds12 & 5 & 11\frac{1}{4}
\end{array}
$$

(2)...

$$7s. \ 5\tfrac{1}{4}d. = 357 \text{ farthings}$$
$$15s. \ 9d. = 756 \quad \text{,,}$$

$$\tfrac{357}{756} + \tfrac{21}{21} = \tfrac{17}{36}$$

$$9s. \ 1\tfrac{1}{4}d. = 437 \text{ farthings}$$
$$15s. \ 10d. = 760 \quad \text{,,}$$

$$\tfrac{437}{760} + \tfrac{19}{19} = \tfrac{23}{40} = \cdot575$$

(3)...

$$
\begin{array}{l}
\text{far.} \\
4) \ 3 \\
\overline{12) \ 0\cdot75} \\
\overline{21) 17\cdot0625} \\
17s. \ 0\tfrac{3}{4}d. = \cdot8125 \text{ of a gui.}
\end{array}
$$

$$\cdot4375 \text{ of 3 gui.} = \pounds1 \ 7s. \ 6\tfrac{3}{4}d.$$

$$
\begin{array}{l}
63 \\
\overline{27\cdot5625s.} \\
12 \\
\overline{6\cdot7500d.} \\
4 \\
\overline{3\cdot0000 \text{ far.}}
\end{array}
$$

(4)... $\cdot6363$ &c. $\times \cdot533$ &c. $= \frac{7}{11} \times \frac{8}{15} = \frac{56}{165} = \cdot339393$ &c.

(5)...
$$(13\sqrt{5})^2 = 169 \times 5 = 845$$
$$(7\sqrt{9})^3 = 7^3 \times (\sqrt{9})^3 = 343 \times 9 \times \sqrt{9}$$
$$= 343 \times 9 \times 3$$
$$= 9261$$

(6)...
$$\frac{3}{10} + \frac{2}{5} + \frac{7}{20} = \frac{6+8+7}{20} = \frac{21}{20}$$

$$\frac{21}{20} \ : \ \frac{3}{10} \ :: \ £157 \ 10s. \ : \ £45$$

$$\frac{21}{20} \ : \ \frac{2}{5} \ :: \ £157 \ 10s. \ : \ £60$$

$$\frac{21}{20} \ : \ \frac{7}{20} \ :: \ £157 \ 10s. \ : \ £52 \ 10s.$$

(7)...

ft.	in.		ft.	in.		ft.	in.		ft.	in.		£	s.	d.		far.
21	9	×	17	6	:	23	3	×	14	8	::	15	17	2¼	=	15225 : x
	12			12			12			12						
261			210			279			176							

$$x = \frac{\overset{31}{\cancel{279}} \times \overset{88}{\cancel{176}} \times \overset{\overset{5}{\cancel{145}}}{\cancel{15225}}}{\underset{29}{\cancel{261}} \times \underset{7}{\cancel{210}}} = 13640 \ \text{far.} = £14 \ 4s \ 2d.$$

(8)...

£	s.	d.	
435	11	1	amount
372	13	4	principal
£62	17	9	int. for 4½ years

$£62 \ 17s. \ 9d. \div 4½ = £13 \ 19s. \ 6d.$ int. for 1 year

£	s.	d.		£	s.	d.		£		£	
372	13	4	:	13	19	6	::	100	:	3¾	per cent.

(9) ..

$$\begin{array}{l} \text{5 per cent.} = \tfrac{1}{20} \\ \text{73 da.} = \tfrac{1}{5}\text{ year} \end{array} \left| \begin{array}{cc} £ & s. \\ 135 & 0 \\ \hline 6 & 15 \text{ int. for 1 year} \\ \hline £1 & 7s. \text{ int. for 73 days} \end{array} \right.$$

Amount of £100 in 73 days, at 5 per cent. per annum

$$= £100 + (£5 \times \tfrac{1}{5}) = £100 + £1 = £101$$

$$\begin{array}{ccccccccc} £ & & £ & & £ & & £ & s. & d. \\ 101 & : & 135 & :: & 1 & : & 1 & 6 & 8\tfrac{80}{101} \end{array}$$

$$\begin{array}{lrrr} & £ & s. & d. \\ \text{Interest, or } bank \text{ discount} = & 1 & 7 & 0 \\ \text{true discount} = & 1 & 6 & 8\tfrac{80}{101} \\ \text{difference} = & & & 3\tfrac{21}{101}d. \end{array}$$

(10)...

$$\sqrt[3]{1715} - \sqrt[3]{2560} + \sqrt[3]{3645} - \sqrt[3]{135}$$

$$= \sqrt[3]{343 \times 5} - \sqrt[3]{512 \times 5} + \sqrt[3]{729 \times 5} - \sqrt[3]{27 \times 5}$$

$$= 7\sqrt[3]{5} - 8\sqrt[3]{5} + 9\sqrt[3]{5} - 3\sqrt[3]{5}$$

$$= 5\sqrt[3]{5}$$

EXERCISE CXXVI.

(1)...

1.
$$\tfrac{5}{7} \quad : \quad \tfrac{9}{11} \quad :: \quad \tfrac{11}{14} \quad : \quad x$$

$$x = \frac{7}{5} \times \frac{9}{11} \times \frac{11}{14} = \frac{9}{10}$$

2.
$$3\tfrac{1}{5} \quad : \quad 4\tfrac{2}{9} \quad :: \quad 17\tfrac{3}{5} \quad : \quad x$$

$$x = \frac{5}{16} \times \frac{38}{9} \times \frac{88}{5} = \frac{209}{9} = 23\tfrac{2}{9}$$

3. $\cdot675$: $\cdot745$ :: $\cdot6875$
                       $1\cdot1$ $1\cdot1$
                ‾‾‾‾‾‾‾
                       $\cdot8195$

4. $7\cdot05$: $7\cdot025$ :: $6\cdot355$
                       $3\cdot1$ $3\cdot1$
                ‾‾‾‾‾‾‾
                       7025
                       21075
                ‾‾‾‾‾‾‾‾
                       $21\cdot7775$

(2)...   (137 ft. 6 in. × 39 ft. 5 in.) ÷ 35 ft. 10 in.

= (1650 in. × 473 in.) ÷ 430 in.

= 780450 sq. in. ÷ 430 in.

= 1815 in. = 151 ft. 3 in.

(3)...
    ac.

$\cdot09375$ = 15 perches
    4
‾‾‾‾‾‾‾
$\cdot37500$
    40
‾‾‾‾‾‾‾‾
$15\cdot00000$ per.

    ro.

$\cdot825$ = 33 perches
    40
‾‾‾‾‾‾‾
$33\cdot000$ per.

33 per. − 15 per. = 18 perches

(4)... $\cdot41666$ &c. $= \dfrac{416-41}{900} = \dfrac{375}{900} = \dfrac{5}{12}$

$\dfrac{5}{12}$ of £1 = 8s. 4d.

(5)...
  men da.   men da.   £   £
  5 × 6 : 7 × 8 :: 7 : x

$x = \dfrac{7 \times \overset{4}{8} \times 7}{\underset{3}{\times 6}} = £\dfrac{196}{15} = £13\ 1s.\ 4d.$

$$
\begin{array}{ccccccc}
\text{men} & \text{da.} & & \text{wo.} & \text{da.} & & \pounds & & \pounds \\
\end{array}
$$

(6)... $\quad 12 \times 7 \quad : \quad 15 \times x \times \tfrac{3}{5} \quad :: \quad 10\tfrac{1}{2} \quad : \quad 9$

$$x = (12 \times 7 \times 9) \div (15 \times \tfrac{3}{5} \times 10\tfrac{1}{2})$$

$$x = \frac{\overset{4}{\cancel{12}}}{1} \times \frac{7}{1} \times \frac{\overset{3}{\cancel{9}}}{1} \times \frac{1}{\underset{3}{\cancel{15}}} \times \frac{\cancel{5}}{\cancel{3}} \times \frac{2}{\underset{3}{\cancel{21}}} = 8 \text{ days}$$

(7)...61·8 lb.=61$\tfrac{4}{5}$ lb. $\pounds$1·2875=$\pounds$1$\tfrac{23}{80}$ 5·546875 cwt.=621$\tfrac{1}{4}$ lb.

$$
\begin{array}{ccccccc}
\text{lb.} & & \text{lb.} & & \pounds & & \\
61\tfrac{4}{5} & : & 621\tfrac{1}{4} & :: & 1\tfrac{23}{80} & : & x
\end{array}
$$

$$x = \frac{\cancel{5}}{\underset{3}{\cancel{309}}} \times \frac{2485}{4} \times \frac{\overset{}{\cancel{103}}}{\underset{16}{\cancel{80}}} = \pounds\frac{2485}{192} = \pounds12 \; 18s. \; 10\tfrac{1}{4}d.$$

(8)...Amount of $\pounds$100 in 8 mo. at 4$\tfrac{1}{2}$ per cent. per annum
$$= \pounds100 + (\pounds4\tfrac{1}{2} \times \tfrac{2}{3}) = \pounds103$$

$$
\begin{array}{ccccccc}
\pounds & & \pounds & & \pounds & & \\
103 & : & 450 & :: & 100 & : & x
\end{array}
$$

$$x = \frac{450 \times 100}{103} = \pounds\frac{45000}{103} = \pounds436 \; 17s. \; 10\tfrac{38}{103}d.$$

(9)... $\qquad 8\tfrac{1}{2}d.$ per lb. $= \pounds3 \; 19s. \; 4d.$ per cwt.

$$
\begin{array}{ccccccccc}
& & & & \pounds & s. & d. & & \pounds \\
125\tfrac{25}{27} & : & 100 & :: & 3 & 19 & 4 & = 3\tfrac{29}{30} & : & x
\end{array}
$$

$$x = \frac{\overset{9}{\cancel{27}}}{\underset{\underset{2}{34}}{\cancel{3400}}} + \frac{\cancel{100}}{1} + \frac{\overset{7}{\cancel{119}}}{\underset{10}{\cancel{30}}} = \pounds\frac{63}{20} = \pounds3 \; 3s. \text{ per cwt.}$$

(10)... $5429409371844676(73684526$
                                 49
                     $143)\overline{\ 529}$
                          429
                 $1466)\overline{10040}$
                        8796
             $14728)\overline{\ 124493}$
                      117824
          $147364)\overline{\ \ 666971}$
                    589456
        $1473685)\overline{\ 7751584}$
                  7368425
      $14736902)\overline{\ 38315946}$
                29473804
    $147369046)\overline{\ 884214276}$
                $\underline{884214276}$

                          $4372454 \dot{7} \dot{9}(759$
                          343
   $7^2 \times 300 = 14700)\overline{\ 94245}$
                        $73500 = 14700 \times 5$
                         $5250 = 7 \times 30 \times 5^2$
                          $125 = 5^3$
                       $\overline{78875}$ subtrahend
$75^2 \times 300 = 1687500)\overline{15370479}$
                      $15187500 = 1687500 \times 9$
                        $182250 = 75 \times 30 \times 9^2$
                           $729 = 9^3$
                      $\overline{15370479}$

EXERCISE CXXVII.

(1)... 1 $\left(\frac{4}{5}+\frac{3}{4}-\frac{2}{3}\right)-\left(\frac{2}{9}-\frac{1}{3}+\frac{4}{5}\right)$

$= \left(\dfrac{48+45-40}{60}\right) - \left(\dfrac{10-15+36}{45}\right)$

$= \frac{53}{60}-\frac{31}{45} = \frac{159}{180}-\frac{124}{180} = \frac{35}{180} = \frac{7}{36}$

2. $(2\frac{3}{5}-1\frac{7}{8}+3\frac{1}{4}) \times (6\frac{2}{3}+4\frac{4}{5}-2\frac{2}{9})$

$= (2\frac{24}{40}-1\frac{35}{40}+3\frac{10}{40}) \times (6\frac{30}{45}+4\frac{36}{45}-2\frac{10}{45})$

$= 3\frac{38}{40} \times 9\frac{11}{45} = \frac{\overset{53}{\cancel{159}}}{\underset{5}{\cancel{40}}} \times \frac{\overset{52}{\cancel{416}}}{\underset{15}{\cancel{45}}} = \frac{2756}{75} = 36\frac{56}{75}$

3. $\dfrac{6\frac{2}{3}-4\frac{4}{5}}{5\frac{3}{5}+3\frac{1}{3}} \div \dfrac{7}{9} = \dfrac{6\frac{10}{15}-4\frac{12}{15}}{5\frac{9}{15}+3\frac{5}{15}} \div \dfrac{7}{9}$

$= \dfrac{1\frac{13}{15}}{8\frac{14}{15}} \div \dfrac{7}{9} = \dfrac{\overset{2}{\cancel{14}}}{67} \times \dfrac{9}{7} = \dfrac{18}{67}$

(2)...

$$\frac{11}{16} \text{ gui.} = \frac{11}{16} \times \frac{21}{1} = \frac{231}{16} = \qquad \overset{s.}{14} \quad \overset{d.}{5\frac{1}{4}}.$$

$$\frac{17}{24} \text{ sov.} = \frac{17}{\underset{6}{\cancel{24}}} \times \frac{\overset{5}{\cancel{20}}}{1} = \frac{85}{6} = \qquad 14 \quad 2$$

$$\frac{9}{10} \text{ cr.} = \frac{9}{\underset{2}{\cancel{10}}} \times \frac{\cancel{5}}{1} = \frac{9}{2} = \qquad 4 \quad 6$$

$$\frac{13}{16} \text{ fl.} = \frac{13}{\underset{8}{\cancel{16}}} \times \frac{\cancel{2}}{1} = \frac{13}{8} = \qquad 1 \quad 7\frac{1}{2}$$

$$\frac{19}{24} = \qquad\qquad 9\frac{1}{2}$$

$$\overline{\qquad £1 \quad 15 \quad 6\frac{1}{4}}$$

(3)...

7 hrs. 25 min. = 445 minutes

1 day = 1440 „

$\frac{445}{1440} \div \frac{5}{5} = \frac{89}{288}$ of a day

4 da. 8 hrs. 40 min. = 6280 minutes

1 week = 10080 „

$\frac{6280}{10080} \div \frac{40}{40} = \frac{157}{252}$ of a week

(4)... $8s.\ 1\tfrac{1}{2}d. = £\tfrac{13}{32}$ $£25\ 17s.\ 8\tfrac{1}{2}d. = £25\tfrac{85}{96}$

$$\underset{\tfrac{13}{32}}{£} \quad : \quad \underset{25\tfrac{85}{96}}{£} \quad :: \quad \underset{19\tfrac{1}{2}}{\text{lb.}} \quad : \quad x$$

$$x = \frac{\cancel{32}}{\cancel{13}} \times \frac{2485}{\cancel{96}} \times \frac{\cancel{39}}{2} = \frac{2485}{2} \text{ lb.} = 11 \text{ cwt. } 10\tfrac{1}{2} \text{ lb.}$$

(5)... $2500 \text{ guineas} = £2625$

$$\frac{49}{\underset{8}{\cancel{200}}} \times \frac{\overset{105}{\cancel{2625}}}{1} = £\frac{5145}{8} = £643 \quad 2s.\ 6d. \quad \text{Eldest}$$

$$\frac{7}{32} \times \frac{2625}{1} = £\frac{18375}{32} = £574 \quad 4s.\ 4\tfrac{1}{2}d. \quad \text{Second}$$

$$\frac{29}{\underset{32}{\cancel{100}}} \times \frac{\overset{525}{\cancel{2625}}}{1} = £\frac{15225}{32} = £475\ 15s.\ 7\tfrac{1}{2}d. \quad \text{Third}$$

$$\frac{9}{\underset{2}{\cancel{50}}} \times \frac{\overset{105}{\cancel{2625}}}{1} = £\frac{945}{2} = £472\ 10s.\ 0d. \quad \text{Fourth}$$

The four elder brothers receive $£\overline{2165\ 12s.\ 6d.}$

$£2625 - £2165\ 12s.\ 6d. = £459\ 7s.\ 6d.$ Youngest

(6)... $\underset{\tfrac{7}{16} \times 50}{\text{cwt.}\ \text{mi.}} \quad : \quad \underset{3\tfrac{9}{32} \times 125}{\text{cwt.}\ \text{mi.}} \quad :: \quad \underset{\tfrac{7}{60}}{£} \quad : \quad x$

$$x = (3\tfrac{9}{32} \times 125 \times \tfrac{7}{60}) \div (\tfrac{7}{16} \times 50)$$

$$= \frac{\overset{7}{\cancel{105}}}{\underset{2}{\cancel{32}}} \times \frac{\overset{5}{\cancel{125}}}{1} \times \frac{7}{\underset{4}{\cancel{60}}} \times \frac{\cancel{16}}{7} \times \frac{1}{\underset{2}{\cancel{50}}}$$

$$= £\tfrac{35}{16} = £2\ 3s.\ 9d.$$

(7)...   £100−£6¼ = £93¾, cost price of £100 share
£100+£8¼ = £108¼, selling   „   „

$$\underset{93\frac{3}{4}}{\overset{£}{}} \quad : \quad \underset{108\frac{1}{4}}{\overset{£}{}} \quad :: \quad \underset{1125}{\overset{£}{}} \quad : \quad \underset{1299}{\overset{£}{}}$$

gain = £1299−£1125 = £174

(8)...

			s.	*d.*		*s.*	*d.*
10 lb.	at	3	0	per lb.	=	30	0 .
8 „	„	3	9	„	=	30	0
6 „	„	4	3	„	=	25	6
24		cost				85*s.*	6*d.*

24 lb. at 4*s.* per lb. = 96*s.*

profit, 96*s.*−85*s.* 6*d.* = 10*s.* 6*d.*

$$\underset{85 \quad 6}{\overset{s. \quad d.}{}} \quad : \quad \underset{10 \quad 6}{\overset{s. \quad d.}{}} \quad :: \quad 100 \quad : \quad 12\tfrac{16}{57} \text{ per cent.}$$

(9)...

	£		mo.	
	150 × 2	=	300	
	210 × 6	=	1260	
	120 × 7	=	840	
	480		2400	

2400÷480 = 5 months*

(10)...

$$52 \quad : \quad x \quad :: \quad x \quad : \quad 117$$

$$x^2 = 52 \times 117$$

$$= 6084$$

$$\therefore x = 78$$

$$68 \quad : \quad x \quad :: \quad x \quad : \quad 153$$

$$x^2 = 68 \times 153$$

$$= 10404$$

$$\therefore x = 102$$

* The above answer is sufficiently accurate for all practical purposes : if interest, *say*, at 5 per cent. per annum, were reckoned, the equated time would be about *half a day* less than 5 months.

EXERCISE CXXVIII.

(1)... $$\frac{11}{15}\times 3\frac{1}{8}\times\frac{1\frac{3}{4}}{7\frac{1}{2}}\times 1\frac{4}{11}\times 2\times 6\frac{2}{5}\times\frac{\frac{4}{5}}{4}\times 3\frac{3}{4}\times 2\frac{2}{7}\times\frac{\frac{3}{7}}{1\frac{3}{4}}$$

$$=\frac{11}{15}\times\frac{25}{8}\times\frac{7}{30}\times\frac{15}{11}\times\frac{2}{1}\times\frac{32}{5}\times\frac{1}{5}\times\frac{15}{4}\times\frac{16}{7}\times\frac{1}{4}=4$$

(2)...1. $(3\frac{4}{5}\text{ of }3\frac{1}{3}\text{ of }7)\div(8\frac{3}{4}\text{ of }6\frac{1}{3}\text{ of }1\frac{5}{8})$

$$=\frac{19}{5}\times\frac{10}{3}\times\frac{7}{1}\times\frac{4}{35}\times\frac{3}{19}\times\frac{5}{8}=1$$

2. $\left(\dfrac{8}{10\frac{2}{7}}+\dfrac{6\frac{2}{3}}{8}-\dfrac{5\frac{5}{7}}{13\frac{5}{7}}\right)\div 7\frac{1}{5}$

$$=(\tfrac{7}{9}+\tfrac{5}{6}-\tfrac{5}{12})\div 7\frac{1}{5}$$

$$=\frac{28+30-15}{36}\div 7\frac{1}{5}=\frac{43}{36}\times\frac{5}{36}=\frac{215}{1296}$$

(3)...

```
         4) 3
      28)15·75
       4) 2·5625
```
2 qrs. 15$\frac{3}{4}$ lb. = ·640625 of a cwt.

```
          min.
       60)15
       24)20·25
        7) 2·84375
```
2 da. 20 hrs. 15 min. = ·40625 of a week

```
                8) 1
  30¼ = 30·25)15·125
            40)27·5
             4) 1·6875
```
1 ro. 27 per. 15$\frac{1}{8}$ yds. = ·421875 of an acre

(4)...
$$84 \text{ gallons of rum}$$
$$16$$
$$14\overline{)1344}$$
$$\overline{96} \text{ gallons of rum and water}$$
$$84$$
$$\overline{12} \text{ gallons of water}$$

(5)...

$$\overset{\text{min.}}{5} \; : \; \overset{\text{hrs.}}{2\tfrac{1}{4}} = \overset{\text{min.}}{\cancel{135}} \; :: \; \overset{\text{gal.}}{7}$$
$$27$$
$$7$$

capacity of cistern $= \overline{189}$ gallons

(6)...

$$5\tfrac{3}{4}+3\tfrac{2}{3} = 5\tfrac{9}{12}+3\tfrac{8}{12} = 9\tfrac{5}{12}$$

£4117 8s. 9d. $= £4117\tfrac{7}{16}$

$$9\tfrac{5}{12} \; : \; 5\tfrac{3}{4} \; :: \; \overset{£}{4117\tfrac{7}{16}} \; : \; x$$

$$x = \frac{\cancel{12}^{3}}{\cancel{113}} \times \frac{23}{\cancel{4}} \times \frac{\cancel{65879}^{583}}{16} = £\frac{40227}{16} = £2514 \; 3s. \; 9d.$$

	£	s.	d.
Value of property left	4117	8	9
Wife's portion	2514	3	9
Daughter's portion	1603	5	0

(7)...   Area of floor $= 26\tfrac{1}{4}$ ft. $\times 15\tfrac{3}{4}$ ft.

Area of 1 yd. matting $= 3$ft. $\times 2\cdot625$ ft. $= 3$ ft. $\times 2\tfrac{5}{8}$ ft.

Matting required, $(26\tfrac{1}{4} \times 15\tfrac{3}{4}) \div (3 \times 2\tfrac{5}{8})$

$$= \frac{105}{\cancel{4}} \times \frac{\cancel{63}^{3}}{\cancel{4}_{2}} \times \frac{1}{\cancel{3}} \times \frac{\cancel{8}^{2}}{\cancel{21}} = \frac{105}{2} = 52\tfrac{1}{2} \text{ yards.}$$

(8)... From 9 A.M. on Friday to 5 P.M. on the following
Wednesday = 128 hours

$$\overset{\text{hrs.}}{24} \;:\; \overset{\text{hrs.}}{128} \;::\; \overset{\text{hr.}}{\tfrac{3}{80}} \;:\; x$$

$$x = \frac{1}{\underset{3}{\cancel{24}}} \times \frac{\overset{8}{\cancel{128}}}{1} \times \frac{\cancel{3}}{\underset{5}{\cancel{80}}} = \tfrac{1}{5}\ \text{hour} = 12\ \text{minutes}$$

(9)... 4 per cent. = $\frac{1}{25}$

$\frac{1}{2}$ „   = $\frac{1}{8}$

6 mo. = $\frac{1}{2}$ of 1 yr.

2 mo. = $\frac{1}{3}$ of 6 mo.

	£	s.	d.	
	225	16	8	
	9	0	8	
	1	2	7	
	10	3	3	interest for 1 year
	5	1	7½	
	1	13	10½	
	£16	18	9	int. for 1 yr. 8 mo.

(10)... $\overset{£}{71\tfrac{1}{4}}$: $\overset{£}{3000}$ :: $\overset{£}{4}$: required income

$$\text{required income} = \frac{4}{\underset{19}{\cancel{285}}} \times \frac{\overset{200}{\cancel{3000}}}{1} \times \frac{4}{1} = £\frac{3200}{19} = £168\ 8s.\ 5\tfrac{1}{19}d.$$

EXERCISE CXXIX.

				s.	d.	£	s.	d.
(1)...	347½	yds.	Calico	0	8½	= 12	6	1¾
	279¾	„	do.	0	10	= 11	13	1½
	265¼	„	Irish Linen	1	7	= 21	0	4½
	149¼	„	Flannel	1	5	= 10	11	5¼
	94¾	„	Linen Sheeting ...	2	2	= 10	5	3¼
						£65	16	4½

(2)...
$$\frac{7\frac{5}{9}}{9\frac{11}{12}} = \frac{\frac{68}{9}}{\frac{119}{12}} = \frac{\overset{4}{\cancel{68}} \times \overset{4}{\cancel{12}}}{\underset{7}{\cancel{119}} \times \underset{3}{\cancel{9}}} = \frac{16}{21}$$

$$\frac{8\frac{1}{10}}{14\frac{2}{5}} = \frac{\frac{81}{10}}{\frac{72}{5}} = \frac{\overset{9}{\cancel{81}} \times \cancel{5}}{\underset{8}{\cancel{72}} \times \underset{2}{\cancel{10}}} = \frac{9}{16}.$$

$$\frac{9}{16} \text{ of } 20 \text{ sov.} = \frac{9}{\underset{4}{\cancel{16}}} \times \frac{\overset{5}{\cancel{20}}}{1} = \frac{45}{4} = \overset{£}{11} \quad \overset{s.}{5} \quad \overset{d.}{0}$$

$$\frac{16}{21} \text{ of } 7\frac{1}{2} \text{ gui.} = \frac{\overset{2}{\cancel{16}}}{\underset{}{\cancel{21}}} \times \frac{\overset{3}{\cancel{63}}}{\cancel{8}} = 6 = \quad 6 \quad 0 \quad 0$$

$$\overline{£5 \quad 5 \quad 0}$$

(3)...

Let $x = \cdot392708333$ &c.
then $10000000\ x = 3927083\cdot33$ &c.
and $1000000\ x = 392708\cdot33$ &c.
$\overline{9000000\ x = 3534375}$

$$x = \frac{3534375}{9000000} = \frac{377}{960}$$

$$\frac{377}{960} \text{ of } £1 = \frac{377}{\underset{48}{\cancel{960}}} \times \frac{\cancel{20}}{1} = \frac{377}{48}s. = 7s.\ 10\tfrac{1}{4}d.$$

(4)... $44\frac{2}{5}$ E. ells $= 55\frac{1}{2}$ yds. $178\cdot875$ yds. $= 178\frac{7}{8}$ yds.

$$\overset{\text{yds.}}{55\tfrac{1}{2}} \quad : \quad \overset{\text{yds.}}{178\tfrac{7}{8}} \quad :: \quad \overset{£}{6\tfrac{15}{16}} \quad : \quad x$$

$$x = \frac{\cancel{2}}{\cancel{111}} \times \frac{1431}{\underset{4}{\cancel{8}}} \times \frac{\cancel{111}}{16} = £\frac{1431}{16} = £22\ 7s.\ 2\tfrac{1}{4}d.$$

(5)...
$$\text{A can do } \tfrac{4}{21} \text{ in 1 day}$$
$$\text{B } \quad,, \quad \tfrac{4}{25} \quad,,$$
$$\text{C } \quad,, \quad \tfrac{1}{7} \quad,,$$
$$\text{D } \quad,, \quad \tfrac{4}{35} \quad,,$$

$$\text{A+B+C+D can do } \tfrac{4}{21}+\tfrac{4}{25}+\tfrac{1}{7}+\tfrac{4}{35} \text{ in 1 day}$$

$$\frac{4}{21}+\frac{4}{25}+\frac{1}{7}+\frac{4}{35} = \frac{100+84+75+60}{525} = \frac{319}{525}$$

$$\tfrac{319}{525} \; : \; 1 \; :: \; \overset{\text{day}}{1} \; : \; \overset{\text{days}}{x}$$

$$x = \tfrac{525}{319} = 1\tfrac{206}{319} \text{ days}$$

(6)...
$$1° \; 27' \text{ E.}$$
$$5° \; 47' \text{ W.}$$
$$\text{Difference of longitude} = \overline{7° \; 14'}$$

$$1° \; : \; 7° \; 14' \; :: \; \overset{\text{min.}}{4} \; : \; 28 \text{ min. } 56 \text{ sec.}$$

i.e. the time at the North Foreland is 28 min. 56 sec. *in advance of* that at the Land's End.

(7)...
$$2° \; 54' \text{ W.}$$
$$57° \; 28' \text{ E.}$$
$$\text{Difference of longitude} = \overline{60° \; 22'}$$

$$1° \; : \; 60° \; 22' \; :: \; \overset{\text{min.}}{4} \; : \; 4 \text{ hrs. 1 min. 28 sec.}$$

Time at Chester   6 hrs. 30 min.   0 sec. A.M.
Difference of time   4 hrs. 1 min. 28 sec.
Time at Port Louis 10 hrs. 31 min. 28 sec. A.M.

(8)...
Sum of squares = 1189000
$$678^2 = \quad 459684$$
Square of greater no. = $\overline{729316}$(854
      64
   165)‾893
      825
  1704)‾6816
     6816
   ‾‾‾‾‾‾‾

The greater number is 854

(9)...   Greater number $= \sqrt{319225} = 565$

$$565^3 = 180362125$$
$$\text{difference} = 102507642$$
$$\text{cube of less no.} = \overline{778544483}(42^7$$

$$64$$

$$4^2 \times 300 = 4800)\overline{13854}$$

$$9600 = 4800 \times 2$$
$$480 = 4 \times 30 \times 2^2$$
$$8 = 2^3$$
$$\overline{10088} \text{ subtrahend}$$

$$42^2 \times 300 = 529200)\ \overline{3766483}$$

$$3704400 = 529200 \times 7$$
$$61740 = 42 \times 30 \times 7^2$$
$$343 = 7^3$$
$$\overline{3766483}$$

(10)... For £104 worth, at the *retail* price, he pays £75, thus gaining £29

$$\begin{array}{ccccccc} £ & & £ & & & & \\ 104 & : & 29 & :: & 100 & : & x \end{array}$$

$$x = \frac{29 \times \overset{25}{\cancel{100}}}{\underset{26}{\cancel{104}}} = \frac{725}{26} = 27\tfrac{23}{26} \text{ per cent. out of receipts}$$

To find the gain per cent. on the *outlay* :—

$$\begin{array}{ccccccc} £ & & £ & & & & \\ 75 & : & 29 & :: & 100 & : & x \end{array}$$

$$x = \frac{29 \times \overset{4}{\cancel{100}}}{\underset{3}{\cancel{75}}} = \frac{116}{3} = 38\tfrac{2}{3} \text{ per cent.}$$

EXERCISE CXXX.

(1)... The gentleman had walked $(3\frac{1}{2} \times 1\frac{1}{2} =)$ $5\frac{1}{4}$ miles, when his servant started from Warrington

$$20 \text{ miles} - 5\frac{1}{4} \text{ miles} = 14\frac{3}{4} \text{ miles}$$

They met in $\{14\frac{3}{4} \div (3\frac{1}{2} + 7\frac{1}{2}) =\}$ $1\frac{15}{44}$ hours after the servant started

$$3\frac{1}{2} \times 1\frac{15}{44} = \frac{7}{2} \times \frac{59}{44} = \frac{413}{88} = 4\frac{61}{88} \text{ miles}$$

$$5\frac{1}{4} \text{ mi.} + 4\frac{61}{88} \text{ mi.} = 9\frac{83}{88} \text{ miles} = 9 \text{ mi. } 7 \text{ fur. } 120 \text{ yds.}$$

(2)...1.   1 qr. 1 na. $= \frac{1}{4}$ of 1 ell

	s.	*d.*	
	11	3	per ell
		$6 \times 12 + 3 = 75$	
	3	7	6
			12
40	10	0	
	1	13	9

2 na. $= \frac{1}{10}$ of 1 ell

	2	$9\frac{3}{4}$
	1	$1\frac{1}{2}$
£42	7	$8\frac{1}{4}$

2.   576 cu. in. $= \frac{1}{3}$ of 1 cu. ft.

	s.	*d.*	
	4	6	per cubic foot
		$4 \times 9 + 3 = 39$	
	18	0	
		9	
8	2	0	
	13	6	

192 ,, $= \frac{1}{3}$ of 576 in.
72 ,, $= \frac{1}{8}$ of 576 in.

	1	6
		6
		$2\frac{1}{4}$
£8	17	$8\frac{1}{4}$

$$
\begin{array}{cccc}
 & \pounds & s. & d. \\
3. & 13 & 10 & 0 \text{ per ton} \\
\end{array}
$$

$$4 \times 4 + 1 = 17$$

$$
\begin{array}{ccc}
\overline{54} & 0 & 0 \\
 & & 4 \\
\end{array}
$$

$$
\begin{array}{lccc}
 & 216 & 0 & 0 \\
5 \text{ cwt.} = \frac{1}{4} \text{ of 1 ton} & 13 & 10 & 0 \\
2 \text{ qrs.} = \frac{1}{10} \text{ of 5 cwt.} & 3 & 7 & 6 \\
1 \text{ qr.} = \frac{1}{2} \text{ of 2 qrs.} & & 6 & 9 \\
14 \text{ lb.} = \frac{1}{2} \text{ of 1 qr.} & & 3 & 4\frac{1}{2} \\
 & & 1 & 8\frac{1}{4} \\
\hline
\pounds 233 & 9 & 3\frac{3}{4} \\
\end{array}
$$

(3)... 5 acres, 3 roods, 20 perches = 28435 sq. yards

242 yards × 220 yards = 53240 „

$$
\begin{array}{ccccccc}
\text{sq. yds.} & & \text{sq. yds.} & & \text{qrs. bu. pks.} & \text{pks.} & \\
28435 & : & 53240 & :: & 26\ 3\ 2 = 846 & : & x \\
\end{array}
$$

$$
x = \frac{\overset{88}{\cancel{53240}} \times \overset{18}{\cancel{846}}}{\underset{47}{\cancel{28435}}} = 1584 \text{ pks.} = 49 \text{ qrs. 4 bu.}
$$

(4)... $\quad 3\frac{7}{16} \quad : \quad 24{\cdot}75 = 24\frac{3}{4} \quad :: \quad 9\frac{7}{8} \quad : \quad x$

$$
x = \frac{\overset{2}{\cancel{16}}}{\underset{5}{\cancel{55}}} \times \frac{\overset{9}{\cancel{99}}}{\underset{2}{\cancel{4}}} \times \frac{79}{\cancel{8}} = \frac{711}{10} = 71\frac{1}{10} = 71{\cdot}1
$$

$$
3\frac{3}{5} \quad : \quad x \quad :: \quad x \quad : \quad 57\frac{3}{5}
$$

$$
x^2 = 3\frac{3}{5} \times 57\frac{3}{5}
$$

$$
= \frac{18}{5} \times \frac{288}{5}
$$

$$
= \frac{5184}{25}
$$

$$
\therefore x = \frac{72}{5} = 14\frac{2}{5}
$$

(5)... $\cdot 533 \ \&c. = \dfrac{53-5}{90} = \dfrac{48}{90} = \dfrac{8}{15}$ $\cdot 444 \ \&c = \dfrac{4}{9}$

$$\dfrac{8}{15} \text{ sov.} = \dfrac{8}{\underset{3}{\cancel{15}}} \times \dfrac{\overset{4}{\cancel{20}}}{1} = \dfrac{32}{3} = \overset{s. \quad d.}{10 \quad 8}$$

$$\dfrac{4}{9} \text{ gui.} = \dfrac{4}{\underset{3}{\cancel{9}}} \times \dfrac{\overset{7}{\cancel{21}}}{1} = \dfrac{28}{3} = \underset{\overline{£1 \ \ 0 \ \ 0}}{9 \ \ 4}$$

(6)... $5\frac{1}{4} + 3\frac{3}{4} + 2\frac{3}{4} = 11\frac{3}{4}$

$$11\tfrac{3}{4} \ : \ 5\tfrac{1}{4} \ :: \ \overset{£}{5640} \ : \ £2520, \text{ wife's share}$$

$$11\tfrac{3}{4} \ : \ 3\tfrac{3}{4} \ :: \ \overset{£}{5640} \ : \ £1800, \text{ son's share}$$

$$11\tfrac{3}{4} \ : \ 2\tfrac{3}{4} \ :: \ \overset{£}{5640} \ : \ £1320, \text{ daughter's share}$$

(7)...

$$\begin{array}{lll} \text{A} + \text{B} + \text{C} \text{ scored} & 52 & \text{runs} \\ \underline{\text{B} + \text{C} \qquad \text{,,} \quad 39 \quad \text{,,}} \\ \therefore \quad \text{A} \qquad\quad \text{,,} \quad 13 \quad \text{,,} \end{array}$$

$$\begin{array}{lll} \text{A} + \text{B} + \text{C} \text{ scored} & 52 & \text{runs} \\ \underline{\text{A} \quad + \text{C} \qquad \text{,,} \quad 35 \quad \text{,,}} \\ \therefore \quad \text{B} \qquad\quad \text{,,} \quad 17 \quad \text{,,} \end{array}$$

$\therefore$ C scored $52 - (13 + 17) = 22$ runs

(8)... $75\frac{3}{11}$ lb. at $16\frac{1}{2}d.$ per lb. $= \overset{£ \quad s. \quad d.}{5 \quad 3 \quad 6}$

cost $= 4 \quad 6 \quad 3$

profit $= \overline{17s. \ 3d.}$

$$\overset{£ \quad s. \quad d.}{4 \quad 6 \quad 3} \ : \ \overset{s. \quad d.}{17 \quad 3} \ :: \ 100 \ : \ 20 \text{ per cent.}$$

(9)...In the solution of questions in Arithmetical Progression the following notation will be used :

$$a = \text{the first term}$$
$$d = \text{the common difference}$$
$$l = \text{the last term}$$
$$m = \text{the number of means}$$
$$n = \text{the number of terms}$$
$$s = \text{the sum of the series}$$

1.

$$\text{Sum of series} = \{2a + (n-1)d\}\frac{n}{2}$$

$$= \{6 + (22 \times 4)\}\tfrac{23}{2}$$

$$= 94 \times \tfrac{23}{2}$$

$$= 1081$$

2.

$$\text{Sum} = \{2a + (n-1)d\}\frac{n}{2}$$

$$= \{4 + (34 \times 1\tfrac{1}{2})\}\tfrac{35}{2}$$

$$= 55 \times \tfrac{35}{2}$$

$$= 962\tfrac{1}{2}$$

3.

$$\text{Sum} = \{2a + (n-1)d\}\frac{n}{2}$$

$$= \{\tfrac{5}{4} + (29 \times \tfrac{1}{2})\}15$$

$$= 15\tfrac{3}{4} \times 15$$

$$= 236\tfrac{1}{4}$$

(10)... Common difference $= \dfrac{l-a}{m+1} = \dfrac{29-5}{7+1} = 3$

hence the means are 8, 11, 14, 17, 20, 23, 26

EXERCISE CXXXI.

(1)...
$$\frac{7}{12}+5\frac{2}{9}+\frac{2\frac{3}{4}}{7}+\frac{5\frac{1}{4}}{7\frac{7}{10}}$$

$$=\tfrac{7}{12}+\tfrac{47}{9}+\tfrac{11}{28}+\tfrac{15}{22}$$

$$=\frac{1617+14476+1089+1890}{2772}$$

$$=\tfrac{19072}{2772}=\tfrac{4768}{693}=6\tfrac{610}{693}\text{, sum}$$

$$13\tfrac{5}{28}-6\tfrac{610}{693}=13\tfrac{495}{2772}-6\tfrac{2440}{2772}=6\tfrac{827}{2772}\text{, difference}$$

(2)...

$$30\tfrac{1}{4}=30{\cdot}25\overline{)15{\cdot}125}\text{ }\underset{}{\overset{8)\;1}{}}$$

$$40\overline{)17{\cdot}5}$$

$$4\overline{)\;3{\cdot}4375}$$

3 ro. 17 per. 15⅛ yds. =   ·859375 of an acre

$$\frac{19}{50}\text{ sq. mile}=\frac{19}{\cancel{50}\,5}\times\frac{\overset{64}{\cancel{640}}}{1}=\frac{1216}{5}\text{ ac.}=243\text{ acres, 32 perches}$$

(3)...

	car.		car.		£	s.	d.
	22	:	24	::	3	17	10½
	11		12				12

$$11\overline{)46\;\;14\;\;\;6}$$
$$\overline{£4\;\;\;4\;\;11\tfrac{5}{11}}$$

(4)...

	oz.		oz.	dwts.		oz.	dwts.		
	12	:	40	10	::	11	2	:	*x*
	20		20			20			
	240		810			222			

$$x=\frac{\overset{27}{\cancel{810}}\times\overset{111}{\cancel{222}}}{\underset{\underset{4}{8}}{\cancel{240}}}=\frac{2997}{4}\text{ dwts.}=37\text{ oz. 9 dwts. 6 grs.}$$

(5)...
$$1\tfrac{5}{17}+1\tfrac{6}{17}+1\tfrac{9}{17}=2\tfrac{13}{17}$$

$$2\tfrac{13}{17} \ : \ 1\tfrac{5}{17} \ :: \ 1880 \ : \ x$$

$$x = \frac{\cancel{17}}{\cancel{47}} \times \frac{22}{\cancel{17}} \times \frac{\overset{40}{\cancel{1880}}}{1} = 880, \text{ number for D}$$

$$2\tfrac{13}{17} \ : \ \tfrac{16}{17} \ :: \ 1880 \ : \ 640, \text{ number for E}$$

$$2\tfrac{13}{17} \ : \ \tfrac{9}{17} \ :: \ 1880 \ : \ 360, \text{ number for F}$$

(6)...
$$4\tfrac{1}{4} \text{ miles} = 7480 \text{ yards}$$

| men | da. | hrs. | men | da. | hrs. | yds. | ft. | in. | yds. | ft. | in. |

$$27 \times 31\tfrac{1}{4} \times 11 \ : \ 60 \times x \times 12 \ :: \ 660 \times 10 \times 22\tfrac{1}{2} \ : \ 7480 \times 12 \times 27$$

$$x = \frac{27 \times 31\tfrac{1}{4} \times 11 \times 7480 \times 12 \times 27}{60 \times 12 \times 660 \times 10 \times 22\tfrac{1}{2}} = \frac{1683}{8} \text{ da.} = 210\tfrac{3}{8} \text{ days}$$

(7)...Annual rent of cottages $= 2s.\ 6d. \times 12 \times 52 = £78$

$$\overset{£}{1000} \ : \ \overset{£}{78} \ :: \ 100 \ : \ 7\tfrac{4}{5} \text{ per cent.}$$

(8)...

		£	s.	d.	
4 per cent. = $\tfrac{1}{25}$	1050	12	6	principal
$\tfrac{1}{2}$,, ,, = $\tfrac{1}{8}$	42	0	6	} interest for 1st year
	5	5	$0\tfrac{3}{4}$	
4 per cent. = $\tfrac{1}{25}$	1097	18	$0\tfrac{3}{4}$	amount at end of 1st year
$\tfrac{1}{2}$,, ,, = $\tfrac{1}{8}$	43	18	$3\tfrac{87}{100}$	} interest for 2nd year
	5	9	$9\tfrac{387}{800}$	
4 per cent. = $\tfrac{1}{25}$	1147	6	$2\tfrac{83}{800}$	amount at end of 2nd year
$\tfrac{1}{2}$,, ,, = $\tfrac{1}{8}$	45	17	$10\tfrac{3283}{20000}$	} interest for 3rd year
	5	14	$8\tfrac{123283}{160000}$	
	£1198	18	$9\tfrac{6147}{160000}$	amount

(9)... $\dfrac{\sqrt{9}+\sqrt{5}}{\sqrt{9}-\sqrt{5}} \times \dfrac{\sqrt{9}+\sqrt{5}}{\sqrt{9}+\sqrt{5}} = \dfrac{14+6\sqrt{5}}{4} = 3\frac{1}{2}+\frac{3}{2}\sqrt{5}$

$$= 3\cdot5+(\tfrac{3}{2} \text{ of } 2\cdot23607)$$
$$= 3\cdot5+3\cdot3541$$
$$= 6\cdot8541$$

$$
\begin{array}{r}
19465109(269 \\
8 \\
\end{array}
$$

$$
\begin{array}{r}
2^2 \times 300 = 1200\,)\overline{11465} \\
7200 = 1200 \times 6 \\
2160 = 2 \times 30 \times 6^2 \\
216 = 6^3 \\
\overline{9576} \text{ subtrahend}
\end{array}
$$

$$
\begin{array}{r}
26^2 \times 300 = 202800\,)\overline{1889109} \\
1825200 = 202800 \times 9 \\
63180 = 26 \times 30 \times 9^2 \\
729 = 9^3 \\
\overline{1889109}
\end{array}
$$

$$\sqrt[3]{238\tfrac{41}{125}} = \sqrt[3]{\tfrac{29791}{125}} = \tfrac{31}{5} = 6\tfrac{1}{5}$$

EXERCISE CXXXII.

(1)...
$$\dfrac{\cdot 0024 \times \cdot 007}{\cdot 00014} = \cdot 12$$

(2)... $\quad 7\cdot6849542 \div 3520 = \cdot002183225625$

$$\sqrt{\cdot002183225625} = \cdot046725$$

(3)...
$$973^2 = 946729$$
$$\text{Difference of squares} = 319465$$
$$\text{Square of less no.} = \overline{627264}(792$$

$$
\begin{array}{r}
49 \\
149\,)\overline{1372} \\
1341 \\
1582\,)\overline{3164} \\
3164 \\
\hline
\end{array}
$$

(4)... $(5\frac{1}{2})^2$: $(7)^2$ :: $105\frac{7}{8}$ Ir. ac. : No. of Eng. ac.

$$\frac{\cancel{4}}{\cancel{121}} \times \frac{49}{1} \times \frac{\overset{7}{\cancel{847}}}{\underset{2}{\cancel{8}}} = \frac{343}{2} = 171\frac{1}{2} \text{ Eng. acres}$$

(5)...

$$92 \text{ gallons} = 46 \text{ dozen}$$

	£	s.
46 dozen at 47s. 6d. per dozen =	109	5
cost =	85	0
profit	£24	5s.

(6)... £5762 10s. $\times \frac{3}{5}$ = £3457 10s.

£ s.	£	£ s. d.	
3457 10 :	1 ::	259 6 3 :	x
2	2	20	
6915	2	5186	
		12	
		62235	

$$x = \frac{2 \times \overset{9}{\cancel{62235}}}{\cancel{6915}} = 18d. = 1s.\ 6d. \text{ in the pound}$$

(7)...

£ s. d.	£ s. d.
1 1 9 × 365 =	396 18 9
$\frac{2}{15}$ of 550 guineas =	77 0 0
	£473 18 9

	£	s.	d.
550 guineas =	577	10	0
Annual expenditure =	473	18	9
,, savings	£103	11	3

(8)...

$$60\overline{)57''}$$
$$60\overline{)37{\cdot}95'}$$
$$65°\ 37'\ 57'' = \overline{65{\cdot}6325°}$$

$$\begin{array}{ccccc} \cancel{360}° & : & 65{\cdot}6325° & :: & \cancel{400}^g \\ 9 & & 10 & & 10 \end{array}$$

$$9\overline{)656{\cdot}3250}$$
$$72{\cdot}9250^g = 72^g\ 92'\ 50''$$

(9)...

$$\sqrt{88\tfrac{44}{49}} = \sqrt{\tfrac{4356}{49}} = \tfrac{66}{7} = 9\tfrac{3}{7}$$

$$\sqrt[3]{254\tfrac{1}{27}} = \sqrt[3]{\tfrac{6859}{27}} = \tfrac{19}{3} = 6\tfrac{1}{3}$$

(10)...   Common difference $= \dfrac{l-a}{m+1} = \dfrac{12\tfrac{1}{2}-3\tfrac{1}{2}}{5+1} = 1\tfrac{1}{2}$

the means are 5, $6\tfrac{1}{2}$, 8, $9\tfrac{1}{2}$, 11

17th term $= 7 + (17-1)3 = 7 + 48 = 55$

EXERCISE CXXXIII.

(1)...   1. $(5\tfrac{3}{8}-2\tfrac{5}{12}) \times (7\tfrac{1}{5}-3\tfrac{3}{10}) \times (8\tfrac{5}{6}-4\tfrac{7}{9})$

$= (5\tfrac{9}{24}-2\tfrac{10}{24}) \times (7\tfrac{2}{10}-3\tfrac{3}{10}) \times (8\tfrac{15}{18}-4\tfrac{14}{18})$

$= 2\tfrac{23}{24} \times 3\tfrac{9}{10} \times 4\tfrac{1}{18}$

$= \dfrac{71}{\underset{8}{\cancel{24}}} \times \dfrac{\overset{13}{\cancel{39}}}{10} \times \dfrac{73}{18} = \dfrac{67379}{1440} = 46\tfrac{1139}{1440}$

2. $\dfrac{\sqrt{24}+\sqrt{289}+\sqrt[3]{512}}{\sqrt{76}+\sqrt{361}-\sqrt[3]{2744}} = \dfrac{\sqrt{24+17+8}}{\sqrt{76+19-14}} = \dfrac{\sqrt{49}}{\sqrt{81}} = \dfrac{7}{9}$

3. $\dfrac{1}{8\tfrac{5}{9}} = \dfrac{9}{77},\quad \dfrac{1}{7\tfrac{9}{77}} = \dfrac{77}{548},\quad \dfrac{8}{4\tfrac{77}{548}} = \dfrac{1644}{2269}$

(2)...

$$7\cdot8625 = 7\tfrac{69}{80}$$

$$13\tfrac{5}{16} + 7\tfrac{69}{80} + 5\tfrac{9}{20} = 25 + \tfrac{5}{16} + \tfrac{69}{80} + \tfrac{9}{20}$$

$$= 25 + \frac{25 + 69 + 36}{80}$$

$$= 25 + \tfrac{130}{80}$$

$$= 26\tfrac{5}{8} = 26\cdot625$$

$$\frac{7}{11} \text{ of } 89\tfrac{8}{25} = \frac{7}{11} \times \frac{2233}{25} = \frac{1421}{25} = 56\tfrac{21}{25}$$

$$56\tfrac{21}{25} - 26\tfrac{5}{8} = 30\tfrac{43}{200} = 30\cdot215$$

(3)...

$$19\cdot9875 = 19\tfrac{79}{80}$$

$$7\tfrac{5}{8} \times \left(\tfrac{23}{40} \text{ of } 19\tfrac{79}{80}\right) = \tfrac{61}{8} \times \tfrac{23}{40} \times \tfrac{1599}{80}$$

$$= \tfrac{2243397}{25600} = 87\tfrac{16197}{25600} = 87\cdot6326953125$$

$$35\cdot525 = 35\tfrac{21}{40}$$

$$35\tfrac{21}{40} + \left(\tfrac{5}{9} \text{ of } 7\tfrac{1}{7}\right) = \tfrac{1421}{40} \times \tfrac{9}{5} \times \tfrac{7}{50}$$

$$= \tfrac{89523}{10000} = 8\tfrac{9523}{10000} = 8\cdot9523$$

(4)... $\tfrac{7}{24}$ crown $= \tfrac{7}{96}$ sov. $\quad \tfrac{1}{16}$ gui. $= \tfrac{21}{320}$ sov.

$$\tfrac{7}{96}, \tfrac{1}{16}, \tfrac{21}{320} = \tfrac{70}{960}, \tfrac{64}{960}, \tfrac{63}{960}$$

(5)...

$$(\cdot83)^2 \times \cdot857142 = \left(\frac{5}{6}\right)^2 \times \frac{6}{7} = \frac{25}{36} \times \frac{6}{7} = \frac{25}{42}$$

$$= \cdot59523809$$

(6)...
$$\cdot 633 \ \&c. = \frac{63-6}{90} = \frac{57}{90} = \frac{19}{30}$$

$$\cdot 63 = \tfrac{63}{100}$$

$$\frac{19}{\cancel{30}} \times \frac{\cancel{25}}{1} = \frac{95}{6}s. = 15s. \ 10d.$$
$$\overset{6}{}$$

$$\frac{63}{\cancel{100}} \times \frac{\cancel{25}}{1} = \frac{63}{4}s. = 15s. \quad 9d.$$
$$\overset{4}{}$$

$$\text{difference} = \overline{\qquad 1d.}$$

(7)...

yds.	in.		yds.	in.		£	s.	d.		
$37\frac{1}{2}$	$\times 22$	:	$53\frac{1}{2}$	$\times 25$	::	8	11	$10\frac{1}{2}$	:	x
2			2			20				
75			107			171				
						12				
						2062				
						4				
						8250				

$$x = \frac{107 \times 25 \times \cancel{8250}}{\cancel{75} \times \cancel{22}} = 13375 \text{ far.} = £13 \ 18s. \ 7\tfrac{3}{4}d.$$

(8)...While the hour hand goes once round, the minute hand goes round 12 times : hence the minute hand gains 11 rounds in 12 hours.

In the question, the minute hand has to gain 8 rounds.

ro.		ro.		hrs.		hrs.	min.
11	:	8	::	12	:	8	$43\frac{7}{11}$

∴ the hands will be together at $43\frac{7}{11}$ min past 8.

☞ $43\frac{7}{11}$ minutes is the same fraction of 1 hour that 8 hours $43\frac{7}{11}$ minutes is of 12 hours, viz. $\tfrac{8}{11}$.

(9)...
$$116323287844(341062$$
$$9$$
$$64)\ \overline{263}$$
$$256$$
$$681)\ \overline{723}$$
$$681$$
$$68206)\ \overline{422878}$$
$$409236$$
$$682122)\ \overline{1364244}$$
$$1364244$$

$$\sqrt{837201991720249} = 28934443$$
$$28934443(307$$
$$27$$
$$30^2 \times 300 = 270000)\ \overline{1934443}$$
$$1890000 = 270000 \times 7$$
$$44100 = 30 \times 30 \times 7^2$$
$$343 = 7^3$$
$$\overline{1934443}$$

(10)... $3\sqrt[3]{448} + 2\sqrt[3]{875} - 4\sqrt[3]{56} + 2\sqrt[3]{1512}$

$= 3\sqrt[3]{64 \times 7} + 2\sqrt[3]{125 \times 7} - 4\sqrt[3]{8 \times 7} + 2\sqrt[3]{216 \times 7}$

$= 12\sqrt[3]{7} + 10\sqrt[3]{7} - 8\sqrt[3]{7} + 12\sqrt[3]{7}$

$= 26\sqrt[3]{7}$

EXERCISE CXXXIV.

(1)...The train from London has travelled 48 miles when the train starts from Chester.

$$178 \text{ miles} - 48 \text{ miles} = 130 \text{ miles}$$

The trains will meet in $\{130 \div (24 + 21)\}$ $2\frac{8}{9}$ hours, or 2 hours $53\frac{1}{3}$ minutes after the train leaves Chester.

hrs. min.

8 30 A.M.

2 53$\frac{1}{3}$

time of meeting $\overline{11}$ 23$\frac{1}{3}$ A.M.

distance from Chester $= 21 \times 2\frac{8}{9} = 60\frac{2}{3}$ miles

(2)... $60 \times 24 \times 2 = 2880$, No. of leaves

$$
2880 \begin{cases} \overset{\text{in.}}{12)13 \cdot 5} \quad = 13\tfrac{1}{2} \text{ inches} \\ 12)\ \overline{1 \cdot 125} \\ 20)\ \overline{\cdot 09375} \end{cases}
$$

$$
\cdot 0046875 \text{ of an inch}
$$

(3)...
$$
\overset{\text{yds.} \quad \text{yds.}}{250 \times 242} \ : \ x \ :: \ \overset{\pounds \quad s.}{7 \ 10} \ : \ \overset{\pounds \quad s.}{5 \ 5}
$$
$$
\begin{array}{cc} 20 & 20 \\ \overline{150} & \overline{105} \end{array}
$$

$$
x = \frac{\overset{5}{\cancel{250}} \times 242 \times \overset{35}{\cancel{105}}}{\underset{\underset{3}{\cancel{150}}}{\cancel{150}}} = 42350 \text{ sq. yds.} = 8\tfrac{3}{4} \text{ acres}
$$

(4)... $10 \cdot 47 \ : \ 19 \cdot 35 \ :: \ \overset{\text{oz. dwt.}}{17 \ 15} \ : \ x$
$$
\begin{array}{c} 20 \\ \overline{355} \end{array}
$$

$$
x = \frac{19 \cdot 35 \times 355}{10 \cdot 47} = 656\tfrac{31}{349} \text{ dwt.} = 32 \text{ oz. } 16\tfrac{31}{349} \text{ dwt.}
$$

(5)... $100°$ of Centigrade $= 212° - 32° = 180°$ of Fahrenheit

$\therefore$ $1°$ of Centigrade $= \tfrac{9}{5}$ of a degree of Fahrenheit

and $1°$ of Fahrenheit $= \tfrac{5}{9}$ of a degree of Centigrade

Hence, the degree on the Centigrade corresponding to $86°$ of Fahrenheit $= \tfrac{5}{9}(86 - 32) = \tfrac{5}{9} \cdot 54° = 30°$.

(6)... The degree on Fahrenheit corresponding to $25°$ on the Centigrade $= \tfrac{9}{5} \cdot 25° + 32° = 45° + 32° = 77°$.

(7)... The watch marks 32 hours 5 minutes in 32 hours

From noon on Thursday to 6.30 P.M. on the following Tuesday
$= 126\frac{1}{2}$ hours

$$
\begin{array}{cccccc}
\text{hrs. min.} & & \text{hrs. min.} & & \text{hrs.} & \\
32 \quad 5 & : & 126 \quad 30 & :: & 32 & : \quad x \\
\underline{60} & & \underline{60} & & & \\
1925 & & 7590 & & &
\end{array}
$$

$$x = \frac{\overset{138}{\cancel{7590}} \times 32}{\underset{35}{\cancel{1925}}} = \frac{4416}{35} \text{ hrs.} = 126 \text{ hrs. } 10\frac{2}{7} \text{ min.}$$

∴ when the hands point to 6.30 on Tuesday evening the correct time is 6 hrs. $10\frac{2}{7}$ min.

(8)... $\qquad$ 27th term $= 5 + (27-1)2\frac{1}{2} = 5 + 65 = 70$

(9)... $\qquad$ Sum of series $= \{2a + (n-1)d\}\dfrac{n}{2}$

$$= \{14\tfrac{1}{2} + (15 \times 1\tfrac{3}{8})\}8$$

$$= (14\tfrac{1}{2} + 20\tfrac{5}{8})8$$

$$= 35\tfrac{1}{8} \times 8 = 281$$

(10)... $\quad (1\tfrac{4}{5})^5 \times (2\tfrac{7}{9})^3 = \dfrac{9}{\cancel{5}} \times \dfrac{9}{\cancel{5}} \times \dfrac{9}{\cancel{5}} \times \dfrac{9}{\cancel{5}} \times \dfrac{9}{\cancel{5}} \times \dfrac{\overset{5}{\cancel{25}}}{\cancel{9}} \times \dfrac{\overset{5}{\cancel{25}}}{\cancel{9}} \times \dfrac{\overset{5}{25}}{\cancel{9}}$

$$= 405$$

$(2\tfrac{2}{3})^6 \div (3\tfrac{5}{9})^3 = \dfrac{8}{\cancel{3}} \times \dfrac{8}{\cancel{3}} \times \dfrac{8}{\cancel{3}} \times \dfrac{8}{\cancel{3}} \times \dfrac{8}{\cancel{3}} \times \dfrac{8}{\cancel{3}} \times \dfrac{9}{\underset{4}{\cancel{32}}} \times \dfrac{9}{\underset{4}{\cancel{32}}} \times \dfrac{9}{\underset{4}{\cancel{32}}}$

$$= 8$$

EXERCISE CXXXV.

(1)...

$$
\begin{array}{r}
\text{ton} \\
\cdot 00029296875 = 10\tfrac{1}{2} \text{ ounces} \\
20 \\
\hline
\cdot 00585937500 \\
4 \\
\hline
\cdot 02343750000 \\
28 \\
\hline
\cdot 65625000000 \\
16 \\
\hline
10\cdot 50000000000 \text{ oz.}
\end{array}
$$

(2)...

$$
£7 \ 14s. \div 23\tfrac{7}{15} = \frac{\overset{7}{\cancel{154}}}{1} \times \frac{15}{\cancel{352}_{16}} = \frac{105}{16}s. = 6s. \ 6\tfrac{3}{4}d.
$$

far.
$$
\begin{array}{r}
4)\overline{3} \\
12)\overline{6\cdot 75} \\
21)\overline{6\cdot 5625}
\end{array}
$$

$6s. \ 6\tfrac{3}{4}d. = \quad \cdot 3125 \text{ of a guinea}$

(3)...

$$
\cdot 0025 = \tfrac{25}{10000} = \tfrac{1}{400}
$$

$$
\cdot 0025 \text{ of a week} = \frac{1}{\cancel{400}_{50}} \times \frac{7}{1} \times \frac{\overset{3}{\cancel{24}}}{1} = \frac{21}{50} \text{ of an hour}
$$

(4)...

$7\cdot 46875 \text{ gui.} = £7 \ 16s. \ 10\tfrac{1}{8}d.$

$$
\begin{array}{r}
7\cdot 46875 \\
21 \\
\hline
9\cdot 84375s. \\
12 \\
\hline
10\cdot 12500d.
\end{array}
$$

$$£5 \cdot 2609375 \;=\; £5 \quad 5s. \quad 2\tfrac{5}{8}d.$$
$$\underline{20}$$
$$5 \cdot 2187500s.$$
$$\underline{12}$$
$$2 \cdot 6250000d.$$

$$17 \cdot 175 \text{ hf. cr.} \;=\; £2 \quad 2s. \quad 11\tfrac{1}{4}d.$$
$$\underline{30}$$
$$5 \cdot 250d.$$
$$\underline{4}$$
$$1 \cdot 000 \text{ far.}$$
$$\overline{£15 \quad 5s. \quad 0d.}$$

$$\frac{11}{14} \text{ of } £22 \; 15s. \;=\; \frac{11}{\cancel{14}_{2}} \times \frac{\overset{13}{\cancel{91}}}{4} \;=\; £\frac{143}{8} \;=\; £17 \; 17s. \; 6d.$$

$$£17 \; 17s. \; 6d. - £15 \; 5s. \;=\; £2 \; 12s. \; 6d.$$

(5)...
$$\cdot 017 \;:\; x \;::\; x \;:\; \cdot 153$$
$$x^2 \;=\; \cdot 017 \times \cdot 153$$
$$\;=\; \cdot 002601$$
$$\therefore x \;=\; \cdot 051$$

(6)...
$$\overset{\text{ft.}}{4\tfrac{1}{4}} \times \overset{\text{ft.}}{1\tfrac{3}{4}} \times \overset{\text{ft.}}{1\tfrac{1}{4}} \;:\; \overset{\text{ft.}}{5\tfrac{1}{2}} \times \overset{\text{ft.}}{2\tfrac{1}{4}} \times \overset{\text{ft.}}{1\tfrac{3}{4}} \;::\; \overset{\text{lb.}}{1338\tfrac{3}{4}} \;:\; x$$

$$x \;=\; (5\tfrac{1}{2} \times 2\tfrac{1}{4} \times 1\tfrac{3}{4} \times 1338\tfrac{3}{4}) \div (4\tfrac{1}{4} \times 1\tfrac{3}{4} \times 1\tfrac{1}{4})$$

$$\;=\; \frac{11}{2} \times \frac{9}{\cancel{4}} \times \frac{7}{\cancel{4}} \times \frac{\overset{\overset{63}{\cancel{315}}}{\cancel{5355}}}{\cancel{4}} \times \frac{\cancel{4}}{\cancel{17}} \times \frac{\cancel{4}}{\cancel{7}} \times \frac{\cancel{4}}{\cancel{5}}$$

$$\;=\; \frac{62337}{2} \text{ lb.} \;=\; 31118\tfrac{1}{2} \text{ lb.}$$

$$(7)\ldots \quad \overset{\text{ac.} \quad \text{yr.}}{17\tfrac{1}{2}\times\tfrac{3}{4}} \quad : \quad \overset{\text{ac.} \quad \text{yr.}}{262\tfrac{1}{2}\times\tfrac{1}{2}} \quad :: \quad \overset{£ \quad s. \quad d.}{32 \; 16 \; 3} = 32\tfrac{13}{16} \quad : \quad x$$

$$x = \frac{\cancel{2}}{\cancel{35}}\times\frac{\cancel{4}}{\cancel{3}}\times\frac{\overset{15}{\cancel{525}}}{\cancel{2}}\times\frac{1}{2}\times\frac{\overset{175}{\cancel{525}}}{\underset{4}{\cancel{16}}} = £\frac{2625}{8} = £328 \; 2s. \; 6d.$$

$$(8)\ldots \qquad \begin{array}{c} £ \\ 67\tfrac{1}{2} \\ 2 \\ \hline 135 \end{array} \quad : \quad \begin{array}{c} £ \\ 100 \\ 2 \\ \hline 200 \end{array} \quad :: \quad \begin{array}{c} £ \\ 3 \end{array} \quad : \quad x$$

$$x = \frac{\overset{40}{\cancel{200}}\times 3}{\underset{27}{\cancel{135}}} = £\frac{120}{27} = £4 \; 8s. \; 10\tfrac{2}{3}d. \text{ int. in 3 per cents,}$$

$$\begin{array}{c} £ \\ 77\tfrac{1}{2} \\ 2 \\ \hline 155 \end{array} \quad : \quad \begin{array}{c} £ \\ 100 \end{array} \quad :: \quad \begin{array}{c} £ \\ 3\tfrac{1}{2} \\ 2 \\ \hline 7 \end{array} \quad : \quad x$$

$$x = \frac{\overset{20}{\cancel{100}}\times 7}{\underset{31}{\cancel{155}}} = £\frac{140}{31} = £4 \; 10s. \; 3\tfrac{27}{31}d. \text{ int. in } 3\tfrac{1}{2} \text{ per cents.}$$

An investment in the $3\tfrac{1}{2}$ per cents. will yield the better interest.

(9)...

$$30099783950929(5486327$$
$$25$$
$$104)\overline{509}$$
$$416$$
$$1088)\overline{9397}$$
$$8704$$
$$10966)\overline{69383}$$
$$65796$$
$$109723)\overline{358795}$$
$$329169$$
$$1097262)\overline{2962609}$$
$$.2194524$$
$$10972647)\overline{76808529}$$
$$76808529$$

$$586376253(837$$
$$512$$
$$8^2 \times 300 = 19200)\overline{74376}$$
$$\overline{57600} = 19200 \times 3$$
$$2160 = 8 \times 30 \times 3^2$$
$$27 = 3^3$$
$$\overline{59787} \text{ subtrahend}$$
$$83^2 \times 300 = 2066700)\overline{14589253}$$
$$\overline{14466900} = 2066700 \times 7$$
$$122010 = 83 \times 30 \times 7^2$$
$$343 = 7^3$$
$$\overline{14589253}$$

(10)...

1.
$$\text{Sum} = \{2a + (n-1)d\}\frac{n}{2}$$
$$= \{6\tfrac{4}{9} + (18 \times \tfrac{5}{9})\} \tfrac{19}{2}$$
$$= (6\tfrac{4}{9} + 10) \tfrac{19}{2}$$
$$= 16\tfrac{4}{9} \times \tfrac{19}{2} = 156\tfrac{2}{9}$$

2.
$$\text{Sum} = \{2a + (n-1)d\}\frac{n}{2}$$
$$= \{10\tfrac{1}{3} + (31 \times \tfrac{1}{2})\}16$$
$$= (10\tfrac{1}{3} + 15\tfrac{1}{2})16$$
$$= 25\tfrac{5}{6} \times 16 = 413\tfrac{1}{3}$$

3. $\text{Sum} = \{2a + (n-1)d\}\dfrac{n}{2}$

$$= \{\tfrac{7}{8} + (23 \times \tfrac{5}{12})\}\,12$$

$$= (\tfrac{7}{8} + 9\tfrac{7}{12})\,12$$

$$= 10\tfrac{3}{4} \times 12 = 129$$

EXERCISE CXXXVI.

(1)... $\overset{s.}{66}$: $\overset{s.\ d.}{2\ 6}$ :: $\overset{oz.}{12}$: $\overset{oz.}{\tfrac{5}{11}}$, weight of half-crown

$$\dfrac{37}{\cancel{40}\atop 8} \text{ of } \dfrac{5}{11} \text{ oz.} = \dfrac{37}{88} \text{ oz.} = 8 \text{ dwt. } 9\tfrac{9}{11} \text{ grs. of silver}$$

$$\dfrac{3}{\cancel{40}\atop 8} \text{ of } \dfrac{5}{11} \text{ oz.} = \dfrac{3}{88} \text{ oz.} = 16\tfrac{4}{11} \text{ grs. of copper}$$

(2)...   1 ton = 15680000 grains

$$\overset{\text{grs.}}{\cancel{200}} \ : \ \overset{\text{grs.}}{\cancel{15680000}} \ :: \ \overset{\text{grs.}}{\cdot 137}$$

$$78400$$
$$\cdot 137$$
$$24\,)\overline{10740\cdot 8} \text{ grains}$$
$$20\,)\ \overline{\ 447 \quad 12\tfrac{4}{5}}$$
$$\overline{\ \ . \ 22 \text{ oz. } 7 \text{ dwts. } 12\tfrac{4}{5} \text{ grs.}}$$

(8)... $5'$ W.
              $151°\ 14'$ E.

Difference of longitude $= \overline{151°\ 19'}$

$1°$: $151°\ 19'$ :: $\overset{\text{min.}}{4}$:   10 hrs. 5 min. 16 sec.

i.e. the time at Sydney is 10 hrs. 5 min. 16 sec. P.M.

(4)... Longitude of Liverpool $\quad$ 2° 59′ W.

$\qquad$ „ $\quad$ of Calcutta $\quad$ 88° 25′ E.

Difference of longitude $\quad \overline{91° 24′}$

$$1° \quad : \quad 91° 24′ \quad :: \quad \overset{\text{min.}}{4} \quad : \quad 6 \text{ hrs. } 5 \text{ min. } 36 \text{ sec.}$$

Time at Calcutta $\qquad$ 12 hrs. $\quad$ 0 min. $\quad$ 0 sec.

Difference of time $\qquad$ 6 hrs. $\quad$ 5 min. $\quad$ 36 sec.

Time at Liverpool $= \overline{5 \text{ hrs. } 54 \text{ min. } 24 \text{ sec.}}$

(5)... $\qquad$ £21000 × $\frac{5}{6}$ = £17500

$$\overset{£}{100} \quad : \quad \overset{£}{17500} \quad :: \quad \overset{£ \quad s.}{3 \quad 10} \quad : \quad \overset{£ \quad s.}{612 \quad 10}$$

$$\begin{array}{lrr} & £ & s. \\ \text{Cost of ship} & 21000 & 0 \\ \text{Paid for insurance} & 612 & 10 \\ \hline & 21612 & 10 \\ \text{Received from insurance company} & 17500 & 0 \\ \hline \text{Total loss} = & £4112 & 10s \end{array}$$

(6)... $\qquad (5\frac{1}{2})^2 \quad : \quad (8)^2 \quad :: \quad \overset{\text{Ch. ac.}}{140} \quad : \quad x$

$$x = \tfrac{4}{121} \times \tfrac{64}{1} \times \tfrac{140}{1} = \tfrac{35840}{121} \text{ stat. ac.} = \overset{\text{ac. po. yds.}}{296 \quad 31 \quad 22\frac{1}{4}}$$

(7)... $\qquad$ Gross value of legacy $\overset{£}{4500}$

Deduct duty, $\frac{1}{10}$th $\qquad$ 450

Net value of legacy $\overline{4050}$

$$2 + 3 + 4 = 9$$

$$\begin{array}{ccccccc} & & & & \overset{£}{} & & \overset{£}{} \\ 9 & : & 2 & :: & 4050 & : & 900 \\ 9 & : & 3 & :: & 4050 & : & 1350 \\ 9 & : & 4 & :: & 4050 & : & 1800 \end{array}$$

(8)...½ year's int.$=\frac{1}{50}$

£	s.	d.	
550	0	0	principal
11	0	0	int. for 1st half-year
561	0	0	amt. at end of 1st hf.-yr.
11	4	$4\frac{4}{5}$	int. for 2nd half-year
572	4	$4\frac{4}{5}$	amt. at end of 2nd hf.-yr.
11	8	$10\frac{82}{125}$	int. for 3rd half-year
583	13	$3\frac{57}{125}$	amt. at end of 3rd hf.-yr.
11	13	$5\frac{1841}{3125}$	int. for 4th half-year
595	6	$9\frac{141}{3125}$	amt. at end of 4th hf.-yr.
11	18	$1\frac{4808}{78125}$	int. for 5th half-year
£607	4	$10\frac{52033}{78125}$	amount in 3½ years

,,   ,, (for 2nd half-year amt.)

(9)...

$$a+(n-1)d = l$$

From this, $n = \dfrac{l-a+d}{d}$

No. of terms $= \dfrac{26\frac{3}{4}-5\frac{1}{2}+1\frac{1}{4}}{1\frac{1}{4}}$

$$= \frac{22\frac{1}{2}}{1\frac{1}{4}} = 18$$

Sum of series $= (a+l)\dfrac{n}{2}$

$$= (5\tfrac{1}{2}+26\tfrac{3}{4})9$$

$$= 32\tfrac{1}{4} \times 9$$

$$= 290\tfrac{1}{4}$$

(10)... $\dfrac{\sqrt{5+\frac{1}{3}} \div \sqrt{4-\frac{4}{5}}}{\sqrt{5+\frac{1}{3}} \times \sqrt{4-\frac{4}{5}}} = \dfrac{\dfrac{4}{\sqrt{3}} \div \dfrac{4}{\sqrt{5}}}{\dfrac{4}{\sqrt{3}} \times \dfrac{4}{\sqrt{5}}} = \dfrac{\dfrac{\sqrt{5}}{\sqrt{3}}}{\dfrac{16}{\sqrt{3}.\sqrt{5}}}$

$$= \frac{\sqrt{5} \times \sqrt{3} \times \sqrt{5}}{16 \times \sqrt{3}} = \frac{5}{16}$$

EXERCISE CXXXVII.

(1)...
$$\underset{\text{in.}}{29\tfrac{1}{2}} \times \underset{\text{in.}}{22\tfrac{3}{4}} \times 24 \times 20 = 322140 \text{ square inches}$$
$$= 248 \text{ sq. yds. } 5 \text{ sq. ft. } 12 \text{ sq. in.}$$

(2)...
$$10 \text{ cu. ft. } 1188 \text{ cu. in.} = 18468 \text{ cu. inches}$$
$$1 \text{ cu. yard} = 46656 \text{ „ „}$$

$$\tfrac{18468}{46656} \div \tfrac{972}{972} = \tfrac{19}{48} \text{ of a cubic yard}$$

(3)...
$$\left(\frac{5-3\tfrac{2}{9}}{2\tfrac{8}{9}+2\tfrac{6}{9}}\right)^{\tfrac{1}{2}} + \left(\frac{4\tfrac{1}{12}+2\tfrac{2}{3}}{13\tfrac{6}{12}-3\tfrac{1}{3}}\right)^{\tfrac{1}{2}} = \sqrt{\frac{16}{49}} + \sqrt{\frac{81}{121}}$$

$$= \frac{4}{7} + \frac{9}{11} = \frac{44+63}{77} = \frac{107}{77} = 1\tfrac{30}{77}$$

(4)...
$$\underset{\pounds}{3} \ \underset{s.}{17} \ \underset{d.}{10\tfrac{1}{2}} = \underset{\text{far.}}{3738} \ : \ \underset{\text{far.}}{960} \ :: \ \underset{\text{dwt.}}{20} \ : \ x$$

$$x = \frac{\overset{160}{\cancel{960}} \times 20}{\underset{623}{\cancel{3738}}} = \frac{3200}{623} \text{ dwt.} = 5 \text{ dwt. } 3\tfrac{171}{623} \text{ grs.}$$

(5)...Reduction on refined sugar 5s. 6d. per cwt.; on brown sugar 3s. 4d. per cwt.

$\tfrac{3}{4}$ lb. $\times 365 = 273\tfrac{3}{4}$ lb. refined; $1\tfrac{3}{4}$ lb. $\times 365 = 638\tfrac{3}{4}$ lb. brown

$$\underset{112}{\overset{\text{lb.}}{}} \ : \ \underset{273\tfrac{3}{4}}{\overset{\text{lb.}}{}} \ :: \ \underset{5}{\overset{s.}{}} \ \underset{6}{\overset{d.}{}} \ : \ 13s. \ 5\tfrac{71}{224}d.$$

$$\underset{112}{\overset{\text{lb.}}{}} \ : \ \underset{638\tfrac{3}{4}}{\overset{\text{lb.}}{}} \ :: \ \underset{3}{\overset{s.}{}} \ \underset{4}{\overset{d.}{}} \ : \ 19s. \ 0\tfrac{1}{8}d.$$

$$13s. \ 5\tfrac{71}{224}d. + 19s. \ 0\tfrac{1}{8}d. = \pounds 1 \ 12s. \ 5\tfrac{99}{224}d.$$

(6)...   36 dozen at 16 for a shilling $=$ 27$^{s.}$

                           cost $=$ 21

                       profit $=$ $\overline{6s.}$

$$\overset{s.}{21} \quad : \quad \overset{s.}{6} \quad :: \quad 100 \quad : \quad 28\tfrac{4}{7} \text{ per cent.}$$

(7)...   12875
        5375
     16750
    $\overline{35000}$ cu. ft. at 4s. 6d. per thousand $=$ £7 17 6 (£ s. d.)

        $2\frac{1}{2}$ per cent. discount $= \frac{1}{40} =$ 3 $11\frac{1}{4}$

           cost of gas for the year $=$ £7 13 $6\frac{3}{4}$

£7 13s. $6\frac{3}{4}d.\div365 = 5\tfrac{71}{1460}d.$ per night.

(8)...   Less number $= \sqrt{281961} = 531$

          sum of cubes $=$ 604477900

               $531^{3} =$ 149721291

cube of greater number $= \overline{454756609}(769$

                         343

$7^{2} \times 300 = 14700)\overline{111756}$

                   88200 $= 14700 \times 6$

                    7560 $= 7 \times 30 \times 6^{2}$

                     216 $= 6^{3}$

                 $\overline{95976}$ subtrahend

$76^{2} \times 300 = 1732800)\overline{15780609}$

                  15595200 $= 1732800 \times 9$

                   184680 $= 76 \times 30 \times 9^{2}$

                     729 $= 9^{3}$

                 $\overline{15780609}$

(9)... $\sqrt{1838\tfrac{17}{64}} = \sqrt{\tfrac{117649}{64}} = \tfrac{343}{8}$

              $\sqrt[3]{\tfrac{343}{8}} = \tfrac{7}{2} = 3\tfrac{1}{2}$

(10)...   F. $= \tfrac{9}{5}$. 82·5° $+32° = $ 148·5° $+32° = $ 180·5°

EXERCISE CXXXVIII.

(1)...

$$\left(\frac{6\frac{2}{5}}{8\frac{2}{5}} \times \frac{7\frac{5}{7}}{9\frac{9}{11}} \times \frac{11\frac{4}{7}}{13\frac{5}{14}}\right) \div \frac{4\frac{4}{5}}{7\frac{2}{7}}$$

$$= \frac{\overset{5}{\cancel{20}}}{\cancel{27}} \times \frac{\cancel{11}}{\underset{7}{\cancel{14}}} \times \frac{\overset{3}{\cancel{\overset{6}{\cancel{162}}}}}{\underset{\cancel{17}}{\cancel{187}}} \times \frac{\overset{5}{\cancel{85}}}{\underset{14}{\cancel{56}}} = \frac{75}{98}$$

(2)... $7\cdot9090$ &c. $= 7\frac{10}{11}$; $9\cdot533$ &c. $= 9\frac{8}{15}$

$$7\frac{10}{11} \times 9\frac{8}{15} = \frac{\overset{29}{\cancel{87}}}{\cancel{11}} \times \frac{\overset{13}{\cancel{143}}}{\underset{5}{\cancel{15}}} = \frac{377}{5} = 75\frac{2}{5} = 75\cdot4$$

$$13\cdot7 = 13\frac{7}{9}; \qquad 4\cdot428571 = 4\frac{3}{7}$$

$$13\frac{7}{9} \div 4\frac{3}{7} = \frac{\overset{4}{\cancel{124}}}{9} \times \frac{7}{\cancel{31}} = \frac{28}{9} = 3\frac{1}{9} = 3\cdot1$$

(3)... $$\frac{1}{7} + \frac{2}{5} = \frac{5+14}{35} = \frac{19}{35}; \qquad 1 - \frac{19}{35} = \frac{16}{35}$$

$$\frac{16}{35} \quad : \quad 1 \quad :: \quad \overset{\text{ac.}}{3} \quad : \quad \text{area of field}$$

Area of field $= \frac{35}{16} \times \frac{3}{1} = \frac{105}{16}$ ac. $= 6$ ac. 2 ro. 10 po.
Area of potatoes $= \frac{1}{7}$ of 6 ac. 2 ro. 10 po. $= \qquad 3$ ro. 30 po.
Area of tares $= \frac{2}{5}$ of 6 ac. 2 ro. 10 po. $= 2$ ac. 2 ro. 20 po.

(4)...   1 cwt. 2 qrs. 12 lb. $= 180$ lb.

$100 \; : \; 18\cdot34 \; :: \; 180$ lb. $: \; 33\cdot012$ lb. sulphate of potash
$100 \; : \; 36\cdot20 \; :: \; 180$ lb. $: \; 65\cdot16$ lb. sulphate of alumina
$100 \; : \; 45\cdot46 \; :: \; 180$ lb. $: \; 81\cdot828$ lb. water

(5)...   1 cu. foot of marble weighs 2700 ounces

$$
\begin{array}{ccc}
\text{oz.} & \text{lb.} & \text{cu. in.} \\
2700 & : \quad 475 & :: \quad 1728 \quad : \quad x \\
 & \underline{16} & \\
 & 7600 &
\end{array}
$$

$$
x = \frac{\overset{76}{\cancel{7600}} \times \overset{64}{\cancel{1728}}}{\underset{27}{\cancel{2700}}} = 4864 \text{ cu. in.} = 2 \text{ cu. ft. } 1408 \text{ cu. in.}
$$

(6)...

$$
\underset{£}{x} \times \underset{\text{yrs.}}{4\tfrac{1}{2}} \times \underset{\text{per cent.}}{4} = \underset{£}{2563} \underset{s.}{16} \times \underset{\text{yrs.}}{5\tfrac{1}{2}} \times \underset{\text{per cent.}}{4\tfrac{1}{2}}
$$

$$
x = (2563\tfrac{4}{5} \times 5\tfrac{1}{2} \times 4\tfrac{1}{2}) \div (4\tfrac{1}{2} \times 4)
$$

$$
= \frac{12819}{5} \times \frac{11}{2} \times \frac{\cancel{9}}{\cancel{2}} \times \frac{\cancel{2}}{\cancel{9}} \times \frac{1}{4}
$$

$$
= £\frac{141009}{40} = £3525 \text{ 4s. 6d.}
$$

(7)...

$$
\underset{£}{955} \underset{s.}{16} \times \underset{\text{yrs.}}{x} \times \underset{\text{per cent.}}{4\tfrac{1}{2}} = \underset{£}{796} \underset{s.}{10} \times \underset{\text{yrs.}}{6} \times \underset{\text{per cent.}}{3\tfrac{3}{4}}
$$

$$
x = (796\tfrac{1}{2} \times 6 \times 3\tfrac{3}{4}) \div (955\tfrac{4}{5} \times 4\tfrac{1}{2})
$$

$$
= \frac{\cancel{1593}}{\cancel{2}} \times \frac{\overset{3}{\cancel{6}}}{1} \times \frac{\overset{5}{\cancel{15}}}{\underset{2}{\cancel{4}}} \times \frac{5}{\underset{3}{\cancel{4779}}} \times \frac{\cancel{2}}{\underset{3}{\cancel{9}}}
$$

$$
= \tfrac{25}{6} = 4\tfrac{1}{6} \text{ years}
$$

(8)...

$$
\underset{£}{607} \underset{s.}{10} \times \underset{\text{yrs.}}{5} \times \underset{\text{per cent.}}{x} = \underset{£}{787} \underset{s.}{10} \times \underset{\text{yrs.}}{4\tfrac{1}{2}} \times \underset{\text{per cent.}}{4\tfrac{1}{2}}
$$

$$
x = (787\tfrac{1}{2} \times 4\tfrac{1}{2} \times 4\tfrac{1}{2}) \div (607\tfrac{1}{2} \times 5)
$$

$$
= \frac{\overset{7}{\underset{\cancel{35}}{\cancel{1575}}}}{2} \times \frac{9}{2} \times \frac{\overset{3}{\cancel{9}}}{\cancel{2}} \times \frac{\cancel{2}}{\underset{27}{\cancel{1215}}} \times \frac{1}{\cancel{5}}
$$

$$
= \tfrac{21}{4} = 5\tfrac{1}{4} \text{ per cent.}
$$

							£	s.	d.

(9)... The first payment bears int. for 5 yrs. = 73 2 6

The second „ „ „ 4 yrs. = 58 10 0

The third „ „ „ 3 yrs. = 43 17 6

The fourth „ „ „ 2 yrs. = 29 5 0

The fifth „ „ „ 1 yr. = 14 12 6

Interest = 219 7 6

£325 × 5 = 1625 0 0

Amount due £1844 7 6

(10)...

$$282429536481(531441$$
$$25$$
$$103)\ \overline{324}$$
$$309$$
$$1061)\ \overline{1529}$$
$$1061$$
$$10624)\ \overline{46853}$$
$$42496$$
$$106284)\ \overline{435764}$$
$$425136$$
$$1062881)\ \overline{1062881}$$
$$1062881$$

$$48228544(364$$
$$27$$
$$3^2 \times 300 = 2700)\overline{21228}$$
$$16200 = 2700 \times 6$$
$$3240 = 3 \times 30 \times 6^2$$
$$216 = 6^3$$
$$\overline{19656}\ \text{subtrahend}$$
$$36^2 \times 300 = 388800)\ \overline{1572544}$$
$$1555200 = 388800 \times 4$$
$$17280 = 36 \times 30 \times 4^2$$
$$64 = 4^3$$
$$\overline{1572544}$$

z

EXERCISE CXXXIX.

		£	s.		
(1)...	Wages of captain...............	25	0	per month	
	„ first mate............	7	10	„	„
	„ second mate	5	10	„	„
	„ steward	5	0	„	„
	„ cook...................	3	10	„	„
	„ 18 seamen	45	0	„	„
	„ 6 boys	4	10	„	„
	Total amount of wages =	96	0	„	„
	Maintenance, £2 5s. × 29 =	65	5	„	„
	Wages and keep =	161	5	„	„
			9		
		£1451	5		

ft. in.   ft. in.   ft. in.   ft. in.   £ s. d.   far.

$$(2)...31\ 6\times15\ 2\ \vdots\ 28\ 6\times17\ 4\ \vdots\vdots\ 17\ 9\ 1\tfrac{1}{2}=16758\ \vdots\ x$$

$$\underline{12}\qquad \underline{12}\qquad\quad \underline{12}\qquad \underline{12}$$

$$378\qquad 182\qquad\quad 342\qquad 208$$

$$\overset{\displaystyle 19}{\underset{\displaystyle 3\quad\ 7}{x=\frac{\overset{114}{\cancel{342}}\times\overset{8}{\cancel{208}}\times\overset{\cancel{133}}{\cancel{16758}}}{\cancel{378}\times\cancel{182}}}}= 17328\ \text{far.}\ =\ £18\ 1s.$$

(3)...   1 cu. foot of mahogany weighs 1063 ounces

ft.   ft.   in.

$$10\tfrac{1}{2}\times1\tfrac{1}{4}\times2\tfrac{1}{4} = \tfrac{21}{2}\times\tfrac{5}{4}\times\tfrac{3}{16} = \tfrac{315}{128}\ \text{cu. feet}$$

$$1063\times\tfrac{315}{128} = \tfrac{334845}{128}\ \text{oz.} = 1\ \text{cwt. 1 qr. 23 lb. } 7\tfrac{125}{128}\ \text{oz.}$$

gal.

(4)..   25 fresh water, sp. gr. 1   = 25
        30 sea water, sp. gr. 1·0263 = 30·789
        ‾‾‾   ‾‾‾‾‾‾
        55   55·789

sp. gr. of mixture = 55·789÷55
                   = 1·014345

(5)...55 mi. $-17\frac{1}{2}$ mi. $=37\frac{1}{2}$ miles; 42 wks. -14 wks. $=28$ weeks

$$\begin{array}{ccccccc} \text{men} & \text{wks.} & & \text{mon} & \text{wks.} & & \text{mi.} & & \text{mi.} \\ 420 & \times 14 & : & x & \times 28 & :: & 17\frac{1}{2} & : & 37\frac{1}{2} \end{array}$$

$$x = \frac{\overset{15}{\cancel{420}} \times \overset{2}{\cancel{14}} \times \overset{15}{\cancel{37\frac{1}{2}}}}{\underset{7}{\cancel{28} \times \cancel{17\frac{1}{2}}}} = 450 \text{ men}$$

Additional men required $= 450 - 420 = 30$

(6)...

$$\begin{array}{rll} \pounds & s. & \\ 777 & 12 & = 1 \text{ year's interest} \\ & 20 & \\ \hline 6)15552 & 0 & \text{capital at end of 5th year} \\ 2592 & 0 & \text{increase in 5th year} \\ \hline 6)12960 & 0 & \text{capital at end of 4th year} \\ 2160 & 0 & \text{increase in 4th year} \\ \hline 6)10800 & 0 & \text{capital at end of 3rd year} \\ 1800 & 0 & \text{increase in 3rd year} \\ \hline 6)9000 & 0 & \text{capital at end of 2nd year} \\ 1500 & 0 & \text{increase in 2nd year} \\ \hline 6)7500 & 0 & \text{capital at end of 1st year} \\ 1250 & 0 & \text{increase in 1st year} \\ \hline \pounds 6250 & 0 & \text{original capital} \end{array}$$

(7)...

$$\begin{array}{ccccccc} 13\frac{1}{2} & & 100 & & & \\ 5\frac{1}{4} & & 13\frac{1}{2} & & \pounds & \\ \hline 18\frac{3}{4} & : & 86\frac{1}{2} & :: & 300 & : & \text{sum expended} \end{array}$$

$$\text{Sum expended} = \frac{\overset{2}{\cancel{4}}}{\underset{75}{\cancel{75}}} \times \frac{173}{\underset{2}{\cancel{2}}} \times \frac{\overset{4}{\cancel{300}}}{1} = \pounds 1384$$

(8)...

$$\sqrt[3]{3456} - 7\sqrt[3]{686} + 5\sqrt[3]{1024} + 3\sqrt[3]{54}$$

$$= \sqrt[3]{1728 \times 3} - 7\sqrt[3]{343 \times 2} + 5\sqrt[3]{512 \times 2} + 3\sqrt[3]{27 \times 2}$$

$$= 12\sqrt[3]{2} - 49\sqrt[3]{2} + 40\sqrt[3]{2} + 9\sqrt[3]{2}$$

$$= 12\sqrt[3]{2}$$

z 2

(9).. $\text{Sum of series} = \left\{ 2a + (n-1)d \right\} \dfrac{n}{2}$

$= (26 \times 1\frac{5}{8}) \frac{27}{2}$

$= 42\frac{1}{4} \times 13\frac{1}{2}$

$= 570\frac{3}{8}$

(10)... $\text{14th term} = 7 + (14-1)5 = 7 + 65 = 72$

$\text{10th term} = 5\frac{1}{2} + (10-1)2\frac{1}{2} = 5\frac{1}{2} + 22\frac{1}{2} = 28$

EXERCISE CXL.

(1)...
$$13^2 \;:\; 19^2 \;::\; \overset{\text{ac. ro. po.}}{3 \; 2 \; 31\frac{1}{2}} = 591\frac{1}{2} \;:\; x$$

$$x = \frac{361 \times \cancel{591\frac{1}{2}}^{3\frac{1}{2}}}{\cancel{169}} = 1263\frac{1}{2} \text{ po.} = 7 \text{ ac. } 3 \text{ ro. } 23\frac{1}{2} \text{ po.}$$

(2)... $\frac{4}{5} \text{ min.} = \frac{4}{5} \text{ of } \frac{1}{60} = \frac{1}{75} \text{ hour}$

$$\overset{\text{hr.}}{\frac{1}{75}} \;:\; \overset{\text{hr.}}{\frac{10}{21}} \;::\; \overset{\text{mile}}{\frac{7}{10}} \;:\; x$$

$$x = \frac{\cancel{75}}{1} \times \frac{\cancel{10}}{\cancel{21}} \times \frac{7}{\cancel{10}} = 25 \text{ miles}$$

(3)... $\dfrac{1}{5} + \dfrac{2}{9} + \dfrac{1}{6} + \dfrac{2}{7} = \dfrac{126 + 140 + 105 + 180}{630} = \dfrac{551}{630}$

$1 - \frac{551}{630} = \frac{79}{630}$

$$\overset{}{\frac{79}{630}} \;:\; 1 \;::\; \overset{\text{tr.}}{79} \;:\; 630 \text{ trees}$$

	bu. mo. hrs.		bu. mo. hrs.		cu. ft.		

$$(4)\ldots\quad 7\times3\times5\quad:\quad 11\times7\times7\quad::\quad 5880\quad:\quad x$$

$$x = \frac{11\times\cancel{7}\times7\times\cancelto{\cancelto{392}{1960}}{5880}}{\cancel{7}\times\cancel{3}\times\cancel{5}} = 30184 \text{ cu. feet}$$

$$(5)\ldots\qquad £2\ 10s.\div1s.\ 6d. = 33\tfrac{1}{3}$$

$$\cancelto{20}{27} \quad : \quad 1 \quad :: \quad \overset{£}{33\tfrac{1}{3}} \quad : \quad \text{rent of house}$$

$$\text{Rent of house} = \frac{\cancel{27}}{\cancelto{20}{27}}\times\frac{\cancelto{9}{100}}{\cancelto{5}{3}} = £45 \text{ per annum}$$

					£	s.	d.

$$(6)\ldots\quad 73 \text{ lb. } 10 \text{ oz. at } 3s.\ 9d. \text{ per lb.} = 13\ \ 16\ \ 1\tfrac{1}{8}$$
$$\text{Cost} = 12\ \ \ 5\ \ \ 5$$
$$\text{Profit} = £1\ \ 10\ \ \ 8\tfrac{1}{8}$$

£	s.	d.		£	s.	d.				
12	5	5	:	1	10	8⅛	::	100	:	12½ per cent.

(7)...The three parts will be in the following proportion :—

$$3\times6 = 18$$
$$4\times7 = 28$$
$$5\times8 = \underline{40}$$
$$\overline{86}$$

$$86 \quad : \quad 18 \quad :: \quad 56 \quad : \quad 11\tfrac{31}{43}$$

$$86 \quad : \quad 28 \quad :: \quad 56 \quad : \quad 18\tfrac{10}{43}$$

$$86 \quad : \quad 40 \quad :: \quad 56 \quad : \quad 26\tfrac{2}{43}$$

$$
\begin{array}{lccc}
 & \pounds & s. & d. \\
\text{(8)}\ldots \qquad \text{Cost of 25 yards } = & 9 & 7 & 6 \\
\text{Required profit, } \tfrac{1}{10} = & & 18 & 9 \\
\hline
 & 10 & 6 & 3 \\
\text{10 yds. at } 6s. \text{ per yd. } = & 3 & 0 & 0 \\
\end{array}
$$

$$
25-10 = 15 \left\{ \begin{array}{l} 3)\ \overline{7\ \ 6\ \ 3} \\ 5)\ \overline{2\ \ 8\ \ 9} \end{array}\right.
$$

$$9s.\ 9d.\text{ per yard}$$

(9)...

$$\left(\frac{5}{8}\right)^{\frac{3}{2}} = \sqrt{\left(\frac{5}{8}\right)^3} = \sqrt{(\cdot 625)^3} = \sqrt{\cdot 244160625}$$

$$= \cdot 494105\ldots\ldots$$

(10)...   1.

$$\text{Sum} = \{2a+(n-1)d\}\frac{n}{2}$$

$$= \{118-(15\times 3)\}8$$

$$= 73\times 8$$

$$= 584$$

2.

$$\text{Sum} = \{2a+(n-1)d\}\frac{n}{2}$$

$$= \{33\tfrac{1}{2}-(16\times \tfrac{3}{4})\}\ \tfrac{17}{2}$$

$$= 21\tfrac{1}{2}\times 8\tfrac{1}{2}$$

$$= 182\tfrac{3}{4}$$

3.

$$\text{Sum} = \{2a+(n-1)d\}\ \frac{n}{2}$$

$$= \{39-(19\times 1\tfrac{1}{4})\}10$$

$$= 15\tfrac{1}{4}\times 10$$

$$= 152\tfrac{1}{2}$$

EXERCISE CXLI.

(1)...

$$\frac{\sqrt{7+\frac{1}{5}}+\sqrt{6-\frac{6}{7}}}{\sqrt{7+\frac{1}{5}}\times\sqrt{6-\frac{6}{7}}} = \frac{\dfrac{6}{\sqrt{5}}+\dfrac{6}{\sqrt{7}}}{\dfrac{6}{\sqrt{5}}\times\dfrac{6}{\sqrt{7}}} = \frac{\dfrac{\sqrt{7}}{\sqrt{5}}}{\dfrac{36}{\sqrt{5}.\sqrt{7}}}$$

$$= \frac{\sqrt{7}\times\sqrt{5}\times\sqrt{7}}{36\times\sqrt{5}} = \frac{7}{36}$$

(2)... $(5\frac{4}{9})^2\times(\frac{3}{7}\text{ of }\frac{5}{14}\text{ of }6\frac{3}{4})$

$$= \frac{\overset{7}{\cancel{49}}}{\cancel{9}}\times\frac{\overset{7}{\cancel{49}}}{\cancel{9}}\times\frac{\cancel{3}}{\cancel{7}}\times\frac{5}{\underset{2}{\cancel{14}}}\times\frac{\overset{3}{\cancel{27}}}{4} = \frac{245}{8} = 30\frac{5}{8}$$

$(3\frac{3}{5})^3\div(\frac{8}{15}\text{ of }\frac{9}{20}\text{ of }7\frac{5}{7})$

$$= \frac{\cancel{18}}{\cancel{5}}\times\frac{\overset{2}{\cancel{18}}}{\cancel{5}}\times\frac{\overset{6}{\cancel{18}}}{5}\times\frac{\overset{3}{\cancel{15}}}{\underset{2}{\cancel{8}}}\times\frac{\overset{4}{\cancel{20}}}{\cancel{9}}\times\frac{7}{\underset{3}{\cancel{54}}} = \frac{126}{5} = 25\frac{1}{5}$$

(3)... $63+7 = 70$ gallons

	£	s.	d.
70 gallons at 9s. 6d. =	33	5	0
Cost =	27	11	3
Profit = £5		13	9

£	s.	d.		£	s.	d.				
27	11	3	:	5	13	9	::	100	:	$20\frac{40}{33}$ per cent.

(4)...

$$
\begin{array}{ccccccc}
\pounds & s. & da. & & \pounds & da. & & gui. & & gui. \\
547 & 10 \times 70 & : & 657 \times x & :: & 5 & : & 9 \\
2 & & & 2 \\
\hline
1095 & & & 1314
\end{array}
$$

$$x = \frac{\overset{5}{\cancel{1095}} \times \overset{35}{\cancel{70}} \times \overset{3}{\cancel{9}}}{\underset{\underset{\underset{2}{\cancel{6}}}{\cancel{6}}}{\cancel{1314}} \times \cancel{5}} = 105 \text{ days}$$

(5)...

$$
\begin{array}{clcl}
 & \pounds & yr. \\
A & 6000 \times 1 & = & 6000 \\
B & 5000 \times \frac{4}{5} & = & 4000 \\
C & 7000 \times \frac{3}{5} & = & 4200 \\
\hline
 & & & 14200
\end{array}
$$

$$
\begin{array}{ccccccccc}
 & & & & & \pounds & & \pounds \\
14200 & : & 6000 & :: & 2485 & : & 1050 & \text{A's share}
\end{array}
$$

$$
\begin{array}{ccccccccc}
 & & & & & \pounds \\
14200 & : & 4000 & :: & 2485 & : & 700 & \text{B's share}
\end{array}
$$

$$
\begin{array}{ccccccccc}
 & & & & & \pounds \\
14200 & : & 4200 & :: & 2485 & : & 735 & \text{C's share}
\end{array}
$$

(6)...

1 woman can do $\frac{7}{9}$ of the work of a man

1 boy „ $\frac{7}{12}$ „ „

∴ 5 men + 6 women + 8 boys can do the work of

$$(5 + 6 \cdot \tfrac{7}{9} + 8 \cdot \tfrac{7}{12} =) 14\tfrac{1}{3} \text{ men}$$

$$
\begin{array}{ccccccc}
men & & men & & da. \\
14\tfrac{1}{3} & : & 7 & :: & 4\tfrac{1}{2} & : & x
\end{array}
$$

$$x = {}_4\tfrac{3}{3} \times \tfrac{7}{1} \times \tfrac{9}{2} = \tfrac{189}{86} = 2\tfrac{17}{86} \text{ days}$$

)... $\qquad 4\frac{1}{4} \quad : \quad 3\frac{1}{2} \quad :: \quad \overset{\pounds}{1215} \overset{s.}{10} \quad : \quad x$

$$x = \frac{\cancel{4}}{\cancel{17}} \times \frac{7}{\cancel{2}} \times \frac{\overset{143}{\cancel{2431}}}{\cancel{2}} = \pounds 1001$$

)... See *Exercise CXXXIII.* (8)

In this question the minute-hand has to gain $2\frac{1}{2}$ rounds

$$\underset{11}{\text{ro.}} \quad : \quad \underset{2\frac{1}{2}}{\text{ro.}} \quad :: \quad \underset{12}{\text{hrs.}} \quad : \quad \underset{2\frac{8}{11}}{\text{hrs.}} = \underset{2}{\text{hrs.}} \; \underset{43\frac{7}{11}}{\text{min.}}$$

)...
$$321876944964(567342$$
$$25$$
$$106)\overline{\;718\;}$$
$$636$$
$$1127)\overline{\;8276\;}$$
$$7889$$
$$11343)\overline{\;38794\;}$$
$$34029$$
$$113464)\overline{\;476549\;}$$
$$453856$$
$$1134682)\overline{\;2269364\;}$$
$$\underline{2269364}$$

$$432081216(756$$
$$343$$
$$7^2 \times 300 = 14700)\overline{\;89081\;}$$
$$73500 = 14700 \times 5$$
$$5250 = 7 \times 30 \times 5^2$$
$$125 = 5^3$$
$$\overline{78875} \quad \text{subtrahend}$$
$$75^2 \times 300 = 1687500)\overline{10206216}$$
$$10125000 = 1687500 \times 6$$
$$81000 = 75 \times 30 \times 6^2$$
$$216 = 6^3$$
$$\overline{10206216}$$

```
        36469158961(190969
        1
    29)264
       261
  3809)  36915                         190969(437
         34281                         16
    38186) 263489                  83) 309
           229116                      249
      381929) 3437361            867) 6069
             3437361                   6069
```

```
        34296447249(185193
        1
    28)242
       224
  365)  1896           5² × 300 = 7500) 60193
        1825                            52500 = 7500 × 7
  3701)  7144                            7350 = 5 × 30 × 7²
         3701                             343 = 7³
    37029)344372                        60193
          333261
      370383) 1111149
             1111149
```

(10)...   Let x = the price of a turkey, in pence

     Then $\frac{3}{5}.x =$ „   goose,   „

        $\frac{8}{25}.x =$ „   duck,   „

        $\frac{6}{25}.x =$ „   fowl,   „

        £21 17s. 6d. = 5250 pence

$24.x + 30.\frac{3}{5}.x + 50.\frac{8}{25}.x + 50.\frac{6}{25}.x = 5250$

     $24x + 18x + 16x + 12x = 70x = 5250$

               $x = 75d. = 6s.\ 3d.$, turkeys

             $\frac{3}{5}.x = 45d. = 3s.\ 9d.$, geese

             $\frac{8}{25}.x = 24d. = 2s.\ 0d.$, ducks

             $\frac{6}{25}.x = 18d. = 1s.\ 6d.$, fowls

EXERCISE CXLII.

(1)...The train from Holyhead has travelled $(40\frac{4}{5}\times\frac{1}{3}=)$ $13\frac{3}{5}$ miles when the other train leaves Chester

The trains approach each other at the rate of $40\frac{4}{5}+18=58\frac{4}{5}$ miles per hour

Hence, they will pass each other in $\dfrac{85-13\frac{3}{5}}{58\frac{4}{5}}=\dfrac{17}{14}$ hours

Distance from Chester $=\overset{\text{mi.}}{18}\times\tfrac{17}{14}=\tfrac{153}{7}=21\frac{6}{7}$ miles

(2)... $\sqrt[3]{5\tfrac{104}{125}}\times\sqrt{3\tfrac{6}{25}} = \sqrt[3]{\tfrac{729}{125}}\times\sqrt{\tfrac{81}{25}} = \tfrac{9}{5}\times\tfrac{9}{5} = \tfrac{81}{25} = 3\tfrac{6}{25}$

(3)... $\dfrac{\sqrt{11}+\sqrt{7}}{\sqrt{11}-\sqrt{7}}\times\dfrac{\sqrt{11}+\sqrt{7}}{\sqrt{11}+\sqrt{7}} = \dfrac{18+2\sqrt{77}}{4} = 4\frac{1}{2}+\frac{1}{2}\sqrt{77}$

$$= 4\tfrac{1}{2}+\tfrac{1}{2}(8\cdot77496)$$

$$= 4\cdot5 + 4\cdot38748$$

$$= 8\cdot88748$$

(4)...
men	da.	hrs.	men	da.	hrs.	yds.	ft.	ft.	yds.	ft.	ft.
72	× 9	× 12	: x	× 36	× 9	:: 324	× 36	× 8	: 1458	× 40	× 9

$$x = \frac{\overset{2}{72}\times 9\times \overset{9}{12}\times \overset{5}{1458}\times \overset{3}{40}\times 9}{\underset{2}{36}\times 9\times \underset{3}{324}\times 36\times 8} = 135\text{ men}$$

(5)... 5 per cent. $= \frac{1}{20}$)

	£	s.	d.	
	525	0	0	= 500 guineas
	26	5	0	int. for 1 year
			2	
	£52	10	0	simple int. for 2 years

5 per cent. $= \frac{1}{20}$

	£	s.	d.	
	525	0	0	
	26	5	0	1st year's int.
	551	5	0	
	27	11	3	2nd year's int.
	578	16	3	amount in 2 years
	525	0	0	principal
	53	16	3	comp. int. for 2 years
	52	10	0	

Difference $=$ £1 6 3

(6)...

	oz.	dwt.	
	5739	12	
One-sixth =	956	12	allowance for waste
	4783	0	

17s. per ounce

20)81311

£4065 11s. duty on gold articles

	oz.	dwt.	
	1032958	16	
One-sixth =	172159	16	allowance for waste
	860799		

18d. per ounce

12)15494382

20)1291198 6

64559 18 6 duty on silver articles

4065 11 0   „   gold   „

£68625   9 6 total amount of duty

(7)...

	£	s.	d.
	68625	9	6
Commission, 2½ per cent. =	1715	12	$8\frac{17}{20}$
	£66909	16	$9\frac{3}{20}$

(8) .. Let x = the portion immersed, in inches

$$x \; : \; 9 \; :: \; \cdot 852 \; : \; 1$$

$$x = 7 \cdot 668 \text{ inches}$$

(9)... Let x = the portion below the surface, in feet

then $(x+3\frac{1}{2})$ feet = the whole thickness of the ice

$$x \; : \; x+3\frac{1}{2} \; :: \; \cdot 930 \; : \; 1 \cdot 028$$

$$(1 \cdot 028)x = \cdot 930(x+3\frac{1}{2})$$

$$= (\cdot 930)x+3 \cdot 255$$

$$(\cdot 098)x = 3 \cdot 255$$

$$x = 3 \cdot 255 \div \cdot 098$$

$$= 33\frac{3}{14} \text{ feet}$$

(10)... £45+£54+£55 10s.+£61 10s. = £216

£216	:	£45	::	15s.	:	3s.	1½d.	A.
£216	:	£54	::	15s.	:	3s.	9d.	B.
£216	:	£55 10s.	::	15s.	:	3s.	10¼d.	C.
£216	:	£61 10s.	::	15s.	:	4s.	3¼d.	D.

EXERCISE CXLIII.

(1)...

$$\frac{43}{57}-\frac{9}{17} = \frac{731-513}{969} = \frac{218}{969}$$

$$\frac{218}{969} \div 2 = \frac{109}{969}, \text{ smaller part}$$

$$\frac{109}{969}+\frac{9}{17} = \frac{109}{969}+\frac{513}{969} = \frac{622}{969}, \text{ larger part}$$

$$(2)\ldots\quad \frac{\sqrt{13}-\sqrt{11}}{\sqrt{13}+\sqrt{11}} \times \frac{\sqrt{13}-\sqrt{11}}{\sqrt{13}-\sqrt{11}} = \frac{24-2\sqrt{143}}{2} = 12-\sqrt{143}$$

$$12-\sqrt{143} = 12-11{\cdot}95826$$

$$= {\cdot}04174$$

(3)...

			st.	ar.	ro.	per.	yds.
$(8)^2$	:	$(5\frac{1}{2})^2$	:: 347	2	21	24$\frac{3}{4}$	
256		121				$11 \times 11 = 121$	

$$\begin{array}{c c c c}
& 3824 & 0 & 0 & 0 \\
& & & & 11 \\
\hline
256\left\{\begin{array}{l} 8)42064 \quad 0 \quad 0 \quad 0 \\ 8)5258 \quad 0 \quad 0 \quad 0 \\ 4)657 \quad 1 \quad 0 \quad 0 \end{array}\right. \\
\hline
164 \quad 1 \quad 10 \quad 0
\end{array}$$

164 Cheshire acres, 1 rood, 10 perches

(4)...

$$\tfrac{3}{4} \text{ of } \pounds 65 = \pounds 48 \ 15s.$$

	s.	d.
2 poor-rates	2	6
Highway-rate		6
Church-rate		3
	3	3 in the pound

		£	s.	d.
2s. = $\frac{1}{10}$ of £1		48	15′	0
1s. = $\frac{1}{2}$ of 2s.		4	17	6
3d. = $\frac{1}{4}$ of 1s.		2	8	9
			12	2$\frac{1}{4}$
Parochial rates	£7	18	5$\frac{1}{4}$	

$$\tfrac{4}{5} \text{ of } \pounds 65 = \pounds 52$$

House-tax $= 9d. \times 52 = \pounds 1 \ 19s.$

	£	s.	d.
Annual rent	65	0	0
Parochial rates	7	18	5$\frac{1}{4}$
House-tax	1	19	0
	£74	17	5$\frac{1}{4}$

(5)... 10 ac. 2 ro. 6 per. $28\frac{1}{2}$ sq. yds. = 51030 square yards

men da. hrs.		men da. hrs.		yds. yds.		yds.
$5 \times 6 \times 10\frac{1}{2}$	:	$6 \times 7 \times x$	::	$252 \times 135 \times 3$	:	51030×4

$$x = \frac{5 \times 6 \times 10\frac{1}{2} \times 51030 \times 4}{6 \times 7 \times 252 \times 135 \times 3} = 15 \text{ hours}$$

(6)...

$$\cdot 72323 \ \&c. = \frac{723-7}{990} = \frac{716}{990} = \frac{358}{495}$$

$$\cdot 94141 \ \&c. = \frac{941-9}{990} = \frac{932}{990} = \frac{466}{495}$$

$$\cdot 00735735 \ \&c. = \frac{735}{99900} = \frac{49}{6660}$$

(7)... $38\frac{1}{2}$ miles = 2439360 inches

2 ft. 11 in. $\times 3\frac{1}{7}$ = 110 inches, circumference of fore wheels

4 ft. 1 in. $\times 3\frac{1}{7}$ = 154 inches, circumference of hind wheels

2439360 ÷ 110 = 22176, revolutions by fore wheels

2439360 ÷ 154 = 15840, revolutions by hind wheels

(8)... See *Exercise CXXXVI.* (9)

$$\text{Number of days} = \frac{l-a+d}{d}$$

$$= \frac{37-17+4}{4}$$

$$= 6$$

Distance from London to Buxton $= (a+l)\frac{n}{2}$

$$= (17+37)3$$

$$= 54 \times 3$$

$$= 162 \text{ miles}$$

(9)...
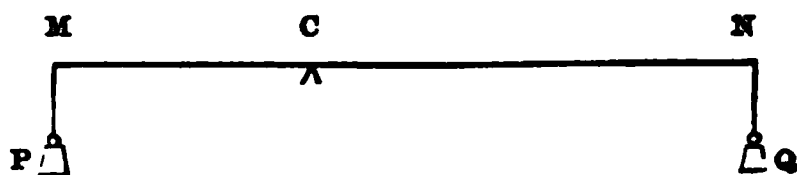
$$P \quad : \quad Q \quad :: \quad CN \quad : \quad CM$$

$$\therefore P \times CM = Q \times CN$$

here, $CM = 16$ in.; $CN = 44-16 = 28$ in.; $Q = 12$ lb.

$$P \times 16 = 12 \times 28$$

$$\therefore P = \frac{12 \times 28}{16} = 21 \text{ lb.}$$

(10)...

Here, $CM = 22$ in.; $CN = 10$ in.; $Q = 55$ lb.

$$P \times 22 = 55 \times 10$$

$$\therefore P = \frac{55 \times 10}{22} = 25 \text{ lb.}$$

EXERCISE CXLIV.

(1)...　April, May, and June, contain 91 days = 13 weeks

per. wk.		per. wks.		oz.		
8×1	:	13×13	::	14	:	18 lb. $7\frac{3}{4}$ oz. of tea

per. wk.		per. wks.		lb.		
8×1	:	13×13	::	$1\frac{3}{4}$	:	36 lb. $15\frac{1}{2}$ oz. of coffee

per. wk.		per. wks.		lb.		
8×1	:	13×13	::	3	:	63 lb. 6 oz. of lump sugar

per. wk.		per. wks.		lb.		
8×1	:	13×13	::	4	:	$84\frac{1}{2}$ lb. of moist sugar

$(2)\ldots$
$$94\tfrac{2}{9} \; : \; x \; :: \; x \; : \; 212$$
$$\therefore x^2 = 94\tfrac{2}{9} \times 212$$
$$= \tfrac{179776}{9}$$
$$x = \tfrac{424}{3} = 141\tfrac{1}{3}$$

$$71\cdot6 \; : \; x \; :: \; x \; : \; 161\cdot1$$
$$\therefore x^2 = 71\cdot6 \times 161\cdot1$$
$$= 11534\cdot76$$
$$x = 107\cdot4$$

$(3)\ldots$
$$\frac{13+\sqrt{18\tfrac{7}{9}}}{\sqrt{7\tfrac{11}{25}}-1\tfrac{2}{3}} + \frac{\sqrt{18\tfrac{13}{49}}-\sqrt{5\tfrac{1}{16}}}{6\tfrac{1}{4}+2\tfrac{4}{7}} = \frac{13+4\tfrac{1}{3}}{2\tfrac{4}{5}-1\tfrac{2}{3}} + \frac{4\tfrac{2}{7}-2\tfrac{1}{4}}{6\tfrac{1}{4}+2\tfrac{4}{7}}$$

$$= \frac{17\tfrac{1}{3}}{1\tfrac{2}{15}} + \frac{2\tfrac{1}{28}}{8\tfrac{23}{28}}$$

$$= \tfrac{260}{17} \times \tfrac{13}{3}$$

$$= \tfrac{3380}{51} = 66\tfrac{14}{51}$$

$(4)\ldots$See *Exercise CXXXIV.* (5)

$$30^\circ \text{ C.} = \tfrac{9}{5}.30^\circ + 32^\circ = 54^\circ + 32^\circ = 86^\circ \text{ F.}$$

$$78\cdot35^\circ \text{ F.} = \tfrac{5}{9}(78\cdot35^\circ - 32^\circ) = \tfrac{5}{9}(46\cdot35^\circ) = 25\cdot75^\circ \text{ C.}$$

Temperature at Paris	30°	C. = 86°	F.
„ „ London	25·75°	C. = 78·35°	F.
Difference of temperature	4·25°	C. = 7·65°	F.

$(5)\ldots$ $14^\circ \text{ F.} = \tfrac{5}{9}(14^\circ - 32^\circ) = \tfrac{5}{9}(-18^\circ) = -10^\circ \text{ C.}$

$(6)\ldots$ $-15^\circ \text{ C.} = \tfrac{9}{5}(-15^\circ) + 32^\circ = -27^\circ + 32^\circ = 5^\circ \text{ F.}$

A A

(7)...The hands are at right angles to each other *twice* between 1 and 2 o'clock, viz. when the minute-hand has gained $1\frac{1}{4}$ rounds, and again, when it has gained $1\frac{3}{4}$ rounds.

$$\overset{\text{ro.}}{11} : \overset{\text{ro.}}{1\frac{1}{4}} :: \overset{\text{hrs.}}{12} : 1 \text{ hr. } 21\tfrac{9}{11} \text{ min.}$$

$$\overset{\text{ro.}}{11} : \overset{\text{ro.}}{1\frac{3}{4}} :: \overset{\text{hrs.}}{12} : 1 \text{ hr. } 54\tfrac{6}{11} \text{ min.}$$

(8)... $\overset{\text{men}}{(6\times5)} + \overset{\text{wo.}}{(8\times3)} + \overset{\text{b.}}{(10\times2)} = 30+24+20 = 74$

$\overset{\text{men}}{(10\times5)} + \overset{\text{wo.}}{(6\times3)} + \overset{\text{b.}}{(12\times2)} = 50+18+24 = 92$

$$\overset{\text{da.}}{74\times25} : \overset{\text{da.}}{92\times x} :: 1 : 2$$

$$x = \frac{\overset{37}{\cancel{74}}\times25\times\cancel{2}}{\underset{\underset{23}{\cancel{46}}}{\cancel{92}}} = \frac{925}{23} \text{ da.} = 40\tfrac{5}{23} \text{ days}$$

(9)...

5 per cent. $= \frac{1}{20}$

$\frac{1}{2}$ „ $= \frac{1}{10}$

2 mo. $= \frac{1}{6}$ of 1 yr.

	£	s.	d.	
	346	12	6	
	17	6	$7\frac{1}{2}$	
	1	14	$7\frac{18}{20}$	
	19	1	$3\frac{9}{20}$	int. for 1 year
	£3	3	$6\frac{23}{40}$	bank discount

Amount of £100 for 2 months at $5\frac{1}{2}$ per cent. per annum
$= £100 + (£5\frac{1}{2} \times \frac{1}{6}) = £100 \ 18s. \ 4d.$

$$\overset{£ \quad s. \quad d.}{100 \ 18 \ 4} : \overset{£ \quad s. \quad d.}{346 \ 12 \ 6} :: \overset{s. \quad d.}{18 \ 4} : £3 \ 2s. \ 11\tfrac{785}{1211}d.$$

	£	s.	d.
Bank discount	3	3	$6\frac{23}{40}$
True discount	3	2	$11\frac{785}{1211}$
Difference ...			$6\frac{44893}{48440}$

(10)...

$$
\begin{array}{r|rrr}
 & £ & s. & d. \\
21 & 607 & 15 & 0\frac{3}{4} \\
 & 28 & 18 & 9\frac{3}{4} \text{ int. for 4th year} \\
\hline
21 & 578 & 16 & 3 \\
 & 27 & 11 & 3 \text{ int. for 3rd year} \\
\hline
21 & 551 & 5 & 0 \\
 & 26 & 5 & 0 \text{ int. for 2nd year} \\
\hline
21 & 525 & 0 & 0 \\
 & 25 & 0 & 0 \text{ int. for 1st year} \\
\hline
£500 & 0 & 0
\end{array}
$$

EXERCISE CXLV.

(1)...
$$
\begin{array}{ccc}
\text{yds.} & & \text{yds.} \\
34\frac{1}{3} & : & 29\frac{3}{4}
\end{array}
:: \begin{array}{ccc} £ & s. & d. \\ 8 & 12 & 6 \end{array} = 8\frac{5}{8} \quad : \quad x
$$

$$
x = \frac{2}{69} \times \frac{119}{\underset{2}{4}} \times \frac{69}{8} = £\frac{119}{16} = £7 \ 8s. \ 9d.
$$

(2)...

			s.	d.		s.	d.
$14\frac{3}{4}$ lb.	Beef	....	0	8	=	9	10
$9\frac{1}{4}$ „	Mutton	....	0	$7\frac{1}{2}$	=	5	$11\frac{1}{4}$
$10\frac{1}{4}$ „	Pork	....	0	7	=	5	$11\frac{3}{4}$
3	Loaves	....	0	$6\frac{1}{2}$	=	1	$7\frac{1}{2}$
	Vegetables	......				2	3
2	Plum-puddings		2	3	=	4	6
3	Apple-pies	......	1	6	=	4	6
$2\frac{1}{2}$ lb.	Cheese	....	0	9	=	1	$10\frac{1}{2}$
	Sundries	....					9
						£1 17	3

	£	s.	d.
28 half-crowns ... =	3	10	0
Cost of dinner ... =	1	17	3
Landlord's profit = £	1	12	9

A A 2

$$
\begin{array}{llll}
 & & \pounds & s. & d. \\
(3)\ldots & 4\ \text{cwt. 1 qr. 14 lb. at } 34s. \text{ per cwt.} = & 7 & 8 & 9 \\
 & 3\ \text{cwt. 2 qrs. 21 lb. } ,,\ \ 36s.\ \ ,,\ \ ,, = & 6 & 12 & 9 \\
 & 5\ \text{cwt. 1 qr.} \qquad\qquad ,,\ \ 40s.\ \ ,,\ \ ,, = & 10 & 10 & 0 \\
\hline
 & 13\ \text{cwt. 1 qr. 7 lb.} & \pounds24 & 11 & 6
\end{array}
$$

$$
\begin{array}{llll}
 & & \pounds & s. & d. \\
13\ \text{cwt. 1 qr. 7 lb. at } 5d. \text{ per lb.} = & 31 & 1 & 3 \\
\text{Cost} = & 24 & 11 & 6 \\
\hline
\text{Profit} = & \pounds6 & 9 & 9
\end{array}
$$

$$
\begin{array}{ccc}
\pounds & s. & d. \\
24 & 11 & 6
\end{array}
:
\begin{array}{ccc}
\pounds & s. & d. \\
6 & 9 & 9
\end{array}
:: \quad 100 \quad : \quad 26\tfrac{3}{5}\tfrac{9}{8}\tfrac{9}{3} \text{ per cent.}
$$

$$
(4)\ldots \qquad \frac{4}{9}+\frac{3}{20}+\frac{4}{15} = \frac{80+27+48}{180} = \frac{155}{180} = \frac{31}{36}
$$

$$
1-\tfrac{31}{36} = \tfrac{5}{36}
$$

$$
\tfrac{5}{36} \quad : \quad 1 \quad :: \quad 175 \quad : \quad 1260, \text{ number present}
$$

$$
\begin{array}{lllccc}
 & & & s. & d. & & \pounds & s. & d. \\
\tfrac{4}{9} \text{ of } 1260 = & 560 \text{ at } & 5 & 0 = & 140 & 0 & 0 \\
\tfrac{3}{20} \text{ of } 1260 = & 189 \text{ at } & 3 & 6 = & 33 & 1 & 6 \\
\tfrac{4}{15} \text{ of } 1260 = & 336 \text{ at } & 2 & 6 = & 42 & 0 & 0 \\
 & 175 \text{ at } & 1 & 0 = & 8 & 15 & 0 \\
\hline
\text{Total receipts} = & & & & \pounds223 & 16 & 6
\end{array}
$$

$$
(5)\ldots\frac{47}{84}\text{ guinea} = \frac{47}{\underset{4}{\cancel{84}}}\times\frac{\cancel{21}}{1} = \frac{47}{4}s. \quad = 11s.\ 9d.
$$

$$
\frac{17}{48}\text{ cwt. } = \frac{17}{\underset{12}{\cancel{48}}}\times\frac{\cancel{4}}{1} = \frac{17}{12}\text{ qrs.} = 1\text{ qr. 11 lb. }10\tfrac{2}{3}\text{ oz.}
$$

$$
\frac{25}{64}\text{ mile } = \frac{25}{\underset{8}{\cancel{64}}}\times\frac{\cancel{8}}{1} = \frac{25}{8}\text{ fur.} = 3\text{ fur. }27\tfrac{1}{2}\text{ yds.}
$$

$$
\frac{43}{60}\text{ acre } = \frac{43}{\underset{15}{\cancel{60}}}\times\frac{\cancel{4}}{1} = \frac{43}{15}\text{ ro.} = 2\text{ ro. 34 po. }20\tfrac{1}{6}\text{ yds.}
$$

$$\frac{7}{36} \text{ cu. yd.} = \frac{7}{\cancel{36}_{4}} \times \frac{\cancel{27}^{3}}{1} = \frac{21}{4} \text{ c. ft.} = 5 \text{ cu. ft. } 432 \text{ cu. in.}$$

$$\frac{33}{50} \text{ week } = \frac{33}{50} \times \frac{7}{1} = \frac{231}{50} \text{ da.} = 4 \text{ da. } 14 \text{ ho. } 52 \text{ min. } 48 \text{ sec.}$$

(6)...

$$
\begin{array}{l}
6)7543 \\
\overline{6)1257} \ldots \ldots 1 \\
\quad \overline{6)209} \ldots \ldots 3 \\
\qquad \overline{6)34} \ldots \ldots 5 \\
\qquad \quad \overline{5} \ldots \ldots 4
\end{array}
$$

$$(7543)_{10} = (54531)_6$$

(7)...

$$
\begin{array}{r}
113210313 \\
4 \\
\overline{5} \\
4 \\
\overline{23} \\
4 \\
\overline{94} \\
4 \\
\overline{377} \\
4 \\
.\overline{1508} \\
4 \\
\overline{6035} \\
4 \\
\overline{24141} \\
4 \\
\overline{96567}
\end{array}
$$

Or thus, $(113210313)_4 = 1.4^8 + 1.4^7 + 3.4^6 + 2.4^5 + 1.4^4 + 3.4^2 + 1.4 + 3$

$$= 65536 + 16384 + 12288 + 2048 + 256 + 48 + 4 + 3$$

$$= (96567)_{10}$$

$(8)\ldots \quad (42314)_5 = 4.5^4 + 2.5^3 + 3.5^2 + 1.5 + 4$

$$= 2500 + 250 + 75 + 5 + 4$$

$$= (2834)_{10}$$

Then,   7)2834

        7)404......6

         7)57......5

          7)8......1

           1......1

$\therefore (42314)_5 = (2834)_{10} = (11156)_7$

     542130234   542130234

     435125354   435125354

sum, 1421300032   difference, 103000440

$(9)\ldots$
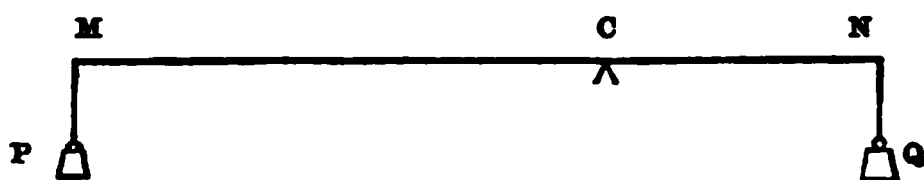
CM=25 in.; CN=13 in.; let $P=x$ lb.; then $Q=(95-x)$ lb.

$$25x = 13(95-x)$$

$$= 1235 - 13x$$

$$38x = 1235$$

$$x = 32\tfrac{1}{2} \text{ lb.}$$

$$95 - x = 62\tfrac{1}{2} \text{ lb.}$$

the weights are $32\tfrac{1}{2}$ lb. and $62\tfrac{1}{2}$ lb. respectively.

$(10)\ldots$
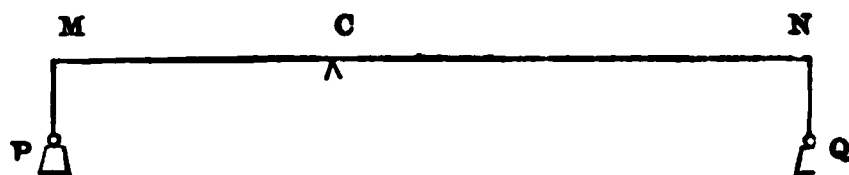
Let $CM=x$ in.; then $CN = (16-x)$ in.; $P=15$ lb.; $Q=9$ lb.

$$15x = 9(16-x)$$

$$= 144 - 9x$$

$$24x = 144$$

$$x = 6 \text{ inches}$$

$$16 - x = 10 \text{ inches}$$

$\therefore$ the fulcrum is 6 inches from P, the greater weight.

EXERCISE CXLVI.

(1)... $\frac{2}{3} - \frac{1}{2} = \frac{1}{6}$

$\frac{1}{6}$: 1 :: £11 13s. $4\frac{1}{2}d.$: £70 0s. 3d.

(2)... $17 \cdot 51375 = 17\frac{411}{800}$

$3\frac{3}{8}$: $17\frac{411}{800}$ :: $11\frac{13}{16}$: x

$$x = \frac{\cancel{8}}{\cancel{27}} \times \frac{14011}{\cancel{800}_{100}} \times \frac{\cancel{189}^{7}}{16} = \frac{98077}{1600} = 61\frac{477}{1600} = 61 \cdot 298125$$

$9\frac{3}{5}$: x :: x : $153\frac{3}{5}$

$$x^2 = 9\frac{3}{5} \times 153\frac{3}{5}$$

$$= \frac{48}{5} \times \frac{768}{5}$$

$$= \frac{36864}{25}$$

$$x = \frac{192}{5} = 38\frac{2}{5}$$

(3)... $\sqrt{51\frac{13}{36}} = \sqrt{\frac{1849}{36}} = \frac{43}{6} = 7\frac{1}{6}$

$\sqrt[3]{2\frac{314}{343}} = \sqrt[3]{\frac{1000}{343}} = \frac{10}{7} = 1\frac{3}{7}$

(4)... Sum gained by expending £3 17s. 9d. $= 1\frac{1}{2}d.$

d.		d.		£	s.	d.	d.		
$1\frac{1}{2}$	:	240	::	3	17	9	= 933	:	x
$\frac{2}{3}$		$\overline{480}^{\,2}$							

$$x = \frac{\cancel{480}^{160} \times 933}{\cancel{3}} = 149280d. = £622$$

(5)...

$$\overset{\text{men}}{5} + (\overset{\text{w.}}{3} \times \tfrac{2}{3}) + (\overset{\text{b.}}{4} \times \tfrac{3}{4} \times \tfrac{2}{3}) = 5 + 2 + 2 = \overset{\text{men}}{9}$$

$$\overset{\text{men da. hrs.}}{4 \times 4\tfrac{1}{2} \times 14} \; : \; \overset{\text{men da. hrs.}}{9 \times 5\tfrac{1}{3} \times x} \; :: \; \overset{\text{ac.}}{5\tfrac{1}{4}} \; : \; \overset{\text{ac.}}{13\tfrac{1}{2}}$$

$$x = (4 \times 4\tfrac{1}{2} \times 14 \times 13\tfrac{1}{2}) \div (9 \times 5\tfrac{1}{3} \times 5\tfrac{1}{4})$$

$$= \frac{4}{1} \times \frac{9}{2} \times \frac{14}{1} \times \frac{27}{2} \times \frac{1}{9} \times \frac{3}{16} \times \frac{4}{21}$$

$$= \tfrac{27}{2} = 13\tfrac{1}{2} \text{ hours}$$

(6)...

$$
\begin{array}{r}
32103 \\
23213 \\
\hline
222321 \\
32103 \\
130212 \\
222321 \\
130212 \\
\hline
(2211332211)_4
\end{array}
$$

$$(2211332211)_4 = 2.4^9 + 2.4^8 + 1.4^7 + 1.4^6 + 3.4^5$$
$$+ 3.4^4 + 2.4^3 + 2.4^2 + 1.4 + 1$$

$$= 524288 + 131072 + 16384 + 4096$$
$$+ 3072 + 768 + 128 + 32 + 4 + 1$$

$$= (679845)_{10}$$

(7)...

$$
\begin{array}{r}
4312)324400041031(34120423 \\
23441 \\
\hline
34440 \\
33303 \\
\hline
11320 \\
4312 \\
\hline
20034 \\
14124 \\
\hline
41010 \\
33303 \\
\hline
22023 \\
14124 \\
\hline
23441 \\
23441 \\
\hline
\end{array}
$$

$$6212432464(64352$$
$$51$$
$$154)\overline{1112}$$
$$1012$$
$$1613)\overline{10043}$$
$$5442$$
$$16165)\overline{130124}$$
$$123254$$
$$161732)\overline{354064}$$
$$\underline{354064}$$

(8)...
	£		£		£	s.		£	s.	d.
	76	:	1558	::	3	5	:	66	12	6

	£		£		£	s.		£	s.
	82	:	1558	::	3	10	:	66	10

£1558 invested in the $3\frac{1}{4}$ per cents. at 76, will yield 2s. 6d. per annum more than the same sum invested in the $3\frac{1}{2}$ per cents. at 82.

(9)...

$$\text{Common difference} = \frac{l-a}{m+1} = \frac{9\frac{1}{8}-5\frac{3}{4}}{8+1} = \frac{3\frac{3}{8}}{9} = \frac{3}{8}$$

∴ the means are $6\frac{1}{8}$, $6\frac{1}{2}$, $6\frac{7}{8}$, $7\frac{1}{4}$, $7\frac{5}{8}$, 8, $8\frac{3}{8}$, $8\frac{3}{4}$

$$\text{Common difference} = \frac{l-a}{m+1} = \frac{78-13}{12+1} = \frac{65}{13} = 5$$

∴ the means are 18, 23, 28, 33, 38, 43, 48, 53, 58, 63, 68, 73

(10)...

24 pints of sulphuric acid,	sp. gr. 1·85	=	44·4
5 „ water	sp. gr. 1	=	5·0
			49·4

Specific gravity of mixture = 49·4÷27·5 = 1·7963

EXERCISE CXLVII.

(1)...

$$1 \text{ mètre} = 39\cdot37079 \text{ inches}$$
$$1000$$
$$1 \text{ kilomètre} = \overline{39370\cdot79} \text{ inches}$$
$$507$$
$$\overline{27559553}$$
$$19685395$$
$$12)\overline{19960990\cdot53}$$
$$3)\overline{1663415\cdot8775}$$
$$1760)\overline{554471\cdot9591}(315 \text{ miles}$$
$$5280$$
$$\overline{2647}$$
$$1760$$
$$\overline{8871}$$
$$8800$$
$$\overline{71\cdot9591} \text{ yards}$$

distance = 315 miles, 71·9591 yds.

(2)...　　Let x = the number of shots fired by each

$$\tfrac{2}{3}.x + \tfrac{5}{9}.x + \tfrac{3}{8}.x = 45$$

$$6x + 20x + 9x = 1080$$

$$45x = 1080$$

$$\therefore x = 24$$

(3)...　　Here, the minute-hand has to gain $5\frac{1}{8}$ rounds

ro.		ro.		hrs.		hrs.	min.	sec.
11	:	$5\frac{1}{8}$	::	12	:	5	38	$10\frac{2}{11}$

(4)... From 8 A.M. to 6 P.M. = 10 hours

The rate of walking *decreases* $\frac{1}{5}$ mile per hour

$$s = \left\{ 2a + (n-1)d \right\} \frac{n}{2}$$
$$= \{9 - (9 \times \tfrac{1}{5})\} 5$$
$$= (9 - 1\tfrac{4}{5}) 5$$
$$= 7\tfrac{1}{5} \times 5 = 36$$

∴ the person will have walked 36 miles in the given time.

(5)... 2*s*. 6*d*. × 52 × 14 = £91, annual rental

$$\overset{£}{7} \; : \; \overset{£}{91} \; :: \; \overset{£}{100} \; : \; \overset{£}{1300}$$

	£	*s.*	*d.*
(6)... 5 per cent. = $\frac{1}{20}$	8000	0	0
	400	0	0
	8400	0	0
,, ,, ,,	420	0	0
	8820	0	0
,, ,, ,,	441	0	0
	9261	0	0
,, ,, ,,	463	1	0
	9724	1	0
,, ,, ,,	486	4	$0\tfrac{3}{5}$
	10210	5	$0\tfrac{3}{5}$
,, ,, ,,	510	10	$3\tfrac{3}{100}$
	10720	15	$3\tfrac{63}{100}$
,, ,, ,,	536	0	$9\tfrac{363}{2000}$

Amount in 7 years £11256 16 $0\tfrac{1623}{2000}$

(7)... $\dfrac{\sqrt{7}+\sqrt{5}}{\sqrt{7}-\sqrt{5}} \times \dfrac{\sqrt{7}+\sqrt{5}}{\sqrt{7}+\sqrt{5}} = \dfrac{12+2\sqrt{35}}{2} = 6 + \sqrt{35}$

$= 6 + 5{\cdot}916079$

$= 11{\cdot}916079$

(8)...
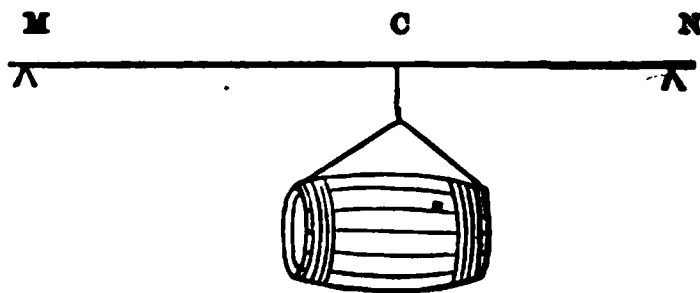
CM = 24 inches; CN = 18 inches

Let x lb. = weight borne by the man at M

then $(350-x)$ lb. =   „   „   „   „   N

$$24.x = 18(350-x)$$
$$= 6300-18x$$
$$42.x = 6300$$

$$\therefore x = 150 \text{ lb.}$$
$$350-x = 200 \text{ lb.}$$

Weight borne by the man at M = 150 lb.

„   „   „   N = 200 lb.

(9)...In the solution of questions in Geometrical Progression the following notation will be used ·

a = the first term

r = the common ratio

l = the last term

m = the number of means

n = the number of terms

s = the sum of the series

1.   Sum of series $= \dfrac{a(r^n-1)}{r-1}$

$$= \frac{5(3^7-1)}{3-1}$$

$$= \frac{5(2187-1)}{2}$$

$$= 5465$$

2. $\quad \text{Sum} = \dfrac{a(r^n - 1)}{r - 1}$

$$= \dfrac{7(4^8 - 1)}{4 - 1}$$

$$= \dfrac{7(65536 - 1)}{3}$$

$$= 152915$$

3. When r is less than unity, it is more convenient to use the following formula :

$$s = \dfrac{a(1 - r^n)}{1 - r}$$

$$= \dfrac{64\{1 - (\frac{1}{2})^{12}\}}{1 - \frac{1}{2}}$$

$$= \dfrac{64(1 - \frac{1}{4096})}{\frac{1}{2}}$$

$$= \dfrac{64 \cdot \frac{4095}{4096}}{\frac{1}{2}}$$

$$= \frac{4095}{32} = 127\frac{31}{32}$$

(10)... $\quad \text{9th term} = ar^{n-1}$

$$= 2 \times 3^8$$

$$= 2 \times 6561$$

$$= 13122$$

12288 is the seventh term of a series, whose first term is 3 ;

$$\therefore 12288 = 3 . r^6$$

$$r^6 = \frac{12288}{3}$$

$$= 4096$$

and $r = 4$

$\therefore$ the means are 12, 48, 192, 768, 3072

EXERCISE CXLVIII.

(1)...The two trains together traverse $52\frac{1}{2}$ miles in an hour: their united length is 462 feet

$$52\frac{1}{2} \text{ miles} = 277200 \text{ feet}$$

ft.		ft.		hr.		sec.
277200	:	462	::	1	:	6

i.e. the trains will have passed each other in 6 seconds.

Proof :—

The slow train will pass over $162\frac{4}{5}$ feet in 6 seconds
The fast   ,,   ,,   ,, $299\frac{1}{5}$,,   ,,   ,,
United length of trains... $= \overline{462}$ feet

(2)...From 8 A.M. on Thursday to 10 P.M. on the following Wednesday $= 158$ hours: in this time the clock has gained $4\frac{1}{2} + 3\frac{3}{5} = 7\frac{9}{10}$ minutes. The question, therefore, is, in how many hours did it gain $4\frac{1}{2}$ minutes ?

min.		min.		hrs.		hrs.
$7\frac{9}{10}$	:	$4\frac{1}{2}$	::	158	:	x

$$x = \frac{10}{79} \times \frac{9}{2} \times \frac{\overset{2}{\cancel{158}}}{1} = 90 \text{ hours}$$

The clock therefore showed the right time 90 hours after 8 A.M. on Thursday, i.e. at 2 P.M. on Monday.

(3)... 19th term $= 11 + (19 - 1)7 = 11 + 126 = 187$

$$\text{sum} = (a + l)\frac{n}{2}$$
$$= (11 + 137)\frac{19}{2}$$
$$= 148 \times 9\frac{1}{2}$$
$$= 1406$$

(4)... $(543214)_6 = 5.6^5 + 4.6^4 + 3.6^3 + 2.6^2 + 1.6 + 4$
$$= 38880 + 5184 + 648 + 72 + 6 + 4$$
$$= (44794)_{10}$$

$(75646328)_9 = 7.9^7 + 5.9^6 + 6.9^5 + 4.9^4 + 6.9^3 + 3.9^2$
$$+ 2.9 + 8$$
$$= 33480783 + 2657205 + 354294$$
$$+ 26244 + 4374 + 243 + 18 + 8$$
$$= (36523169)_{10}$$

Then,

```
3)36523169
3)12174389......2
3)4058129......2
3)1352709......2
3)450903......0
3)150301......0
3)50100......1
3)16700......0
3)5566......2
3)1855......1
3)618......1
3)206......0
3)68......2
3)22......2
3)7......1
  2......1
```

$(75646328)_9 = (36523169)_{10} = (2112201120100222)_3$

Or, the transformation may be performed by one operation, bearing in mind that the digits in 75646328 increase from right to left in a nine-fold proportion:

$$
\begin{array}{r}
3\,)\overline{75646328} \\
3\,)\overline{24815108}\ldots\ldots2 \\
3\,)\overline{7564632}\ldots\ldots2 \\
3\,)\overline{2481510}\ldots\ldots2 \\
3\,)\overline{756463}\ldots\ldots0 \\
3\,)\overline{248151}\ldots\ldots0 \\
3\,)\overline{75646}\ldots\ldots1 \\
3\,)\overline{24815}\ldots\ldots0 \\
3\,)\overline{7564}\ldots\ldots2 \\
3\,)\overline{2481}\ldots\ldots1 \\
3\,)\overline{756}\ldots\ldots1 \\
3\,)\overline{248}\ldots\ldots0 \\
3\,)\overline{75}\ldots\ldots2 \\
3\,)\overline{24}\ldots\ldots2 \\
3\,)\overline{7}\ldots\ldots1 \\
2\ldots\ldots1
\end{array}
$$

$$(75646328)_9 = (2112201120100222)_3$$

(5)...

$$
\begin{array}{ccc}
& 14d. & \\
5d. & & 18d. \\
\hline
4\ \text{lb.} & & 9\ \text{lb.}
\end{array}
$$

∴ there must be 9 lb. of coffee to every 4 lb. of chicory

$$
\begin{array}{cccccccc}
\text{lb.} & & \text{lb.} & & \text{lb.} & & \text{lb.} & \\
4 & : & 9 & :: & 10 & : & 22\tfrac{1}{2} & \text{of coffee}
\end{array}
$$

(6)...   Reduce the prices to sixpences

$$
\begin{array}{ccc}
& 34 & \\
30 & 33 & 37 \\
\hline
3 & 3 & 4 \\
& & 1 \\
\hline
3\ \text{gal.} & 3\ \text{gal.} & 5\ \text{gal.}
\end{array}
$$

3 gallons at 15s.; 3 gallons at 16s. 6d.; and 5 gallons at 18s. 6d. or any multiples of these quantities.

·Proof.

				s.	*d.*
3 gallons at 15s. 0d.	=	45	0
3 „ „ 16s. 6d.	=	49	6
5 „ „ 18s. 6d.	=	92	6
11		187	0

11 gallons at 17s. = 187s.

(7)...
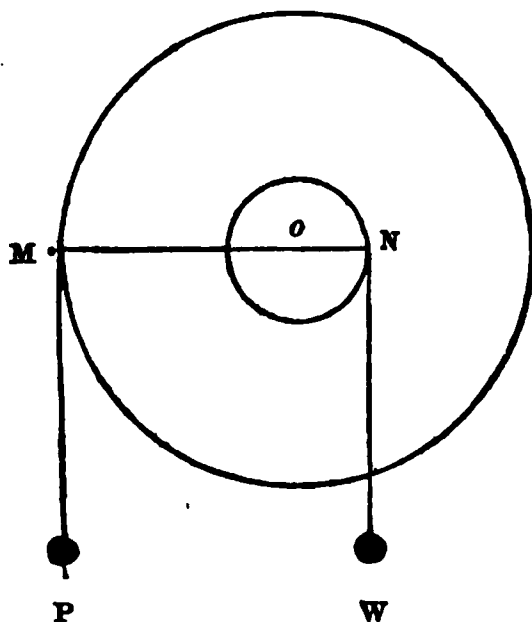
P : W :: radius of axle : radius of wheel

$$\text{P} : \underset{\text{lb.}}{60} :: \underset{\text{in.}}{4} : \underset{\text{in.}}{15}$$

$$\text{P} = \frac{60 \times 4}{15} = 16 \text{ lb.}$$

(8)...See figure in preceding example.

P : W :: radius of axle : radius of wheel

$$\underset{\text{lb.}}{21} : \underset{\text{lb.}}{90} :: \underset{\text{in.}}{3\tfrac{1}{2}} : x$$

$$\text{Radius of wheel} = \frac{90 \times 3\tfrac{1}{2}}{21} = 15 \text{ inches}$$

<table>
<tr><td></td><td></td><td>oz.</td><td>dwt.</td><td>grs.</td></tr>
<tr><td>(9)...</td><td>Weight in air ... =</td><td>3</td><td>17</td><td>21</td></tr>
<tr><td></td><td>Weight in water =</td><td>3</td><td>10</td><td>11</td></tr>
<tr><td></td><td>Weight lost...... =</td><td></td><td>7</td><td>10</td></tr>
</table>

weight lost : whole weight :: sp. gr. of fluid : sp. gr. of body

<table>
<tr><td>dwt.</td><td>grs.</td><td></td><td>dwt.</td><td>grs.</td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>10</td><td>:</td><td>77</td><td>21</td><td>::</td><td>1</td><td>:</td><td>sp. gr. of silver</td></tr>
<tr><td>24</td><td></td><td></td><td>24</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">178</td><td></td><td colspan="2">1869</td><td></td><td></td><td></td><td></td></tr>
</table>

sp. gr. of silver $= \frac{1869}{178} = 10\cdot5$

(10)...Find three numbers which have the same ratio to each other as the required numbers ;

Let 1 be the first

then $\frac{1}{3} \div \frac{1}{5} = \frac{5}{3}$ will be the second

and $\frac{1}{3} \div \frac{1}{7} = \frac{7}{3}$ will be the third

$$1 + \frac{5}{3} + \frac{7}{3} = 5$$

$$\left.\begin{array}{ccccccc}
5 & : & 1 & :: & 90 & : & 18 \\
5 & : & \frac{5}{3} & :: & 90 & : & 30 \\
5 & : & \frac{7}{3} & :: & 90 & : & 42
\end{array}\right\} \text{the required parts}$$

EXERCISE CXLIX.

(1)...   The first four square numbers are 1, 4, 9, 16

The reciprocals of these are 1, $\frac{1}{4}$, $\frac{1}{9}$, $\frac{1}{16}$

$$1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} = \frac{144}{144} + \frac{36}{144} + \frac{16}{144} + \frac{9}{144} = \frac{205}{144}$$

<table>
<tr><td></td><td></td><td></td><td></td><td>£</td><td></td><td>£</td><td>s.</td></tr>
<tr><td>$\frac{205}{144}$</td><td>:</td><td>1</td><td>::</td><td>287</td><td>:</td><td>201</td><td>12</td></tr>
<tr><td></td><td></td><td></td><td></td><td>£</td><td></td><td>£</td><td>s.</td></tr>
<tr><td>$\frac{205}{144}$</td><td>:</td><td>$\frac{1}{4}$</td><td>::</td><td>287</td><td>:</td><td>50</td><td>8</td></tr>
<tr><td></td><td></td><td></td><td></td><td>£</td><td></td><td>£</td><td>s.</td></tr>
<tr><td>$\frac{205}{144}$</td><td>:</td><td>$\frac{1}{9}$</td><td>::</td><td>287</td><td>:</td><td>22</td><td>8</td></tr>
<tr><td></td><td></td><td></td><td></td><td>£</td><td></td><td>£</td><td>s.</td></tr>
<tr><td>$\frac{205}{144}$</td><td>:</td><td>$\frac{1}{16}$</td><td>::</td><td>287</td><td>:</td><td>12</td><td>12</td></tr>
</table>

(2)...   He gains £1¾ on every £100 borrowed

$$\underset{1\frac{3}{4}}{\overset{£}{}} \; : \; \underset{350}{\overset{£}{}} \; :: \; \underset{100}{\overset{£}{}} \; : \; \underset{20000}{\overset{£}{}}$$

(3)...2½ per cent. $= \frac{1}{40}$

	£	s.	d.
	50	0	0
½ „ $= \frac{1}{8}$	1	5	0
		5	0

2½ per cent. $= \frac{1}{40}$ | 51 | 10 | 0 | amount at end of 1st year

½ „ $= \frac{1}{8}$ | 1 | 5 | 9

| | | 5 | 1⅘ |

2½ per cent. $= \frac{1}{40}$ | 53 | 0 | 10⅘ | amount at end of 2nd year

½ „ $= \frac{1}{8}$ | 1 | 6 | 6$\frac{27}{100}$

| | | 5 | 3$\frac{327}{500}$ |

£54 12 8$\frac{181}{250}$ amount in 3 years

(4)...   One pipe admits $\frac{2}{25}$ of contents of bath in 1 minute,

the other   „ $\frac{1}{15}$ „   „   „

The discharging pipe lets out $\frac{1}{10}$ of contents in 1 minute

If all are open together the quantity remaining in the bath at the end of 1 minute

$$= \frac{2}{25} + \frac{1}{15} - \frac{1}{10} = \frac{12+10-15}{150} = \frac{7}{150} \text{ of contents}$$

$$\frac{7}{150} \; : \; 1 \; :: \; 1 \text{ min.} \; : \; 21\frac{3}{7} \text{ minutes}$$

(5)...   Reduce the prices to pence

44d.

36d.	39d.	46d.	51d.
7 lb.	2 lb.	5 lb.	8 lb.

or | 2 lb. | 7 lb. | 8 lb. | 5 lb. |

Ans. 7 lb. at 3s.; 2 lb. at 3s. 3d.; 5 lb. at 3s. 10d.; and 8 lb. at 4s. 3d.

or, 2 lb. at 3s.; 7 lb. at 3s. 3d.; 8 lb. at 3s. 10d.; and 5 lb. at 4s. 3d.

Or any multiples of these quantities.

B B 2

Proof.

	s.	*d.*		*s.*	*d.*			*s.*	*d.*		*s.*	*d.*
7 lb. at	3	0	= 21		0		2 lb. at	3	0	=	6	0
2 lb. „	3	3	= 6		6		7 lb. „	3	3	= 22		9
5 lb. „	3	10	= 19		2		8 lb. „	3	10	= 30		8
8 lb. „	4	3	= 34		0		5 lb. „	4	3	= 21		3
22 lb.			80		8		22 lb.			80		8

$$\text{22 lb. at } 3s. \; 8d. = 80s. \; 8d.$$

(6)... The number of square yards dug by each man forms an Arithmetical Progression.

No. of sq. yds. dug by A $= \{2a + (n-1)d\}\dfrac{n}{2}$

$$= \{900 - (5 \times 12)\}\,3$$

$$= 840 \times 3$$

$$= 2520$$

No. of sq. yds. dug by B $= \{2a + (n-1)d\}\dfrac{n}{2}$

$$= \{900 + (5 \times 15)\}\,3$$

$$= 975 \times 3$$

$$= 2925$$

A has dug 2520 sq. yds. for $11s.$, being at the rate of $229\frac{1}{11}$ sq. yds. for 1 shilling

B has dug 2925 sq. yds. for $13s.$, being at the rate of 225 sq. yds. for 1 shilling

∴ the engagement with A has proved more profitable than that with B.

(7)...
$$
\begin{array}{ccccccc}
\text{gent. da.} & & \text{gent. da.} & & £ & s. & & £ & s. \\
5 \times 25 & : & 11 \times x \times \tfrac{4}{5} & :: & 93 & 15 & : & 112 & 4 \\
& & & & & 20 & & & 20 \\
& & & & \overline{1875} & & & \overline{2244} &
\end{array}
$$

$$
x = \frac{\cancel{5} \times \cancel{25} \times \cancel{2244}}{\cancel{11} \times \cancel{\tfrac{4}{5}} \times \cancel{1875}} = 17 \text{ days}
$$

(8)... The weekly payments are in Arithmetical Progression

1st payment = 20 hf.-cr.; weekly increase = 3 hf.-cr.

$$
\text{Amount of debt} = \{2a + (n-1)d\}\frac{n}{2}
$$

$$
= \{40 + (24 \times 3)\}\frac{\cancel{25}}{2}
$$
$$
= 112 \times 12\tfrac{1}{2}
$$
$$
= 1400 \text{ half-crowns}
$$
$$
= £175
$$

$$
\text{last payment} = a + (n-1)d
$$
$$
= 20 + (24 \times 3)
$$
$$
= 92 \text{ half-crowns}
$$
$$
= £11 \ 10s.
$$

(9)...   36th term $= 3\tfrac{1}{2} + (36-1)1\tfrac{1}{5} = 3\tfrac{1}{2} + 42 = 45\tfrac{1}{2}$

29th term $= 7\tfrac{3}{4} + (29-1)1\tfrac{3}{8} = 7\tfrac{3}{4} + 38\tfrac{1}{2} = 46\tfrac{1}{4}$

(10)...   1. $\text{Sum} = \{2a + (n-1)d\}\dfrac{n}{2}$

$$
= \{13\tfrac{1}{2} + (12 \times 3\tfrac{3}{16})\}\tfrac{13}{2}
$$
$$
= (13\tfrac{1}{2} + 38\tfrac{1}{4})\tfrac{13}{2}
$$
$$
= 51\tfrac{3}{4} \times 6\tfrac{1}{2}
$$
$$
= 336\tfrac{3}{8}
$$

2.
$$\text{Sum} = \{2a+(n-1)d\}\frac{n}{2}$$

$$= \{34\tfrac{3}{5}-(8\times1\tfrac{4}{5})\}\tfrac{9}{2}.$$

$$= (34\tfrac{3}{5}-14\tfrac{2}{5})\tfrac{9}{2}$$

$$= 20\tfrac{1}{5}\times4\tfrac{1}{2}$$

$$= 90\tfrac{9}{10}$$

3.
$$\text{Sum} = \{2a+(n-1)d\}\frac{n}{2}$$

$$= \{11\tfrac{1}{3}-(15\times\tfrac{5}{6})\}8$$

$$= (11\tfrac{1}{3}-12\tfrac{1}{2})8$$

$$= (-1\tfrac{1}{6})8$$

$$= -9\tfrac{1}{3}$$

4.
$$\text{Sum} = \frac{a(r^n-1)}{r-1}$$

$$= \frac{3\tfrac{1}{2}\{(\tfrac{3}{2})^6-1\}}{1\tfrac{1}{2}-1}$$

$$= \frac{3\tfrac{1}{2}(\tfrac{729}{64}-1)}{\tfrac{1}{2}}$$

$$= 7.\tfrac{665}{64}$$

$$= 72\tfrac{47}{64}$$

5.   See *Exercise CXLVII.* (9) 3

$$\text{Sum} = \frac{a(1-r^n)}{1-r}$$

$$= \frac{13\{1-(\tfrac{1}{2})^8\}}{1-\tfrac{1}{2}}$$

$$= \frac{13(1-\tfrac{1}{256})}{\tfrac{1}{2}}$$

$$= 26.\tfrac{255}{256}$$

$$= 25\tfrac{115}{128}$$

6.
$$\text{Sum} = \frac{a}{1-r}$$
$$= \frac{8}{1-\frac{3}{4}}$$
$$= \frac{8}{\frac{1}{4}}$$
$$= 32$$

EXERCISE CL.

(1)...   A+B+C can do $\frac{2}{21}$ in 1 day

A+B   „ $\frac{2}{29}$ „

B+C   „ $\frac{2}{33}$ „

A can do $\frac{2}{21} - \frac{2}{33} = \frac{22-14}{231} = \frac{8}{231}$ in 1 day

C can do $\frac{2}{21} - \frac{2}{29} = \frac{58-42}{609} = \frac{16}{609}$ in 1 day

∴ A+C can do $\frac{8}{231} + \frac{16}{609} = \frac{232+176}{6699} = \frac{136}{2233}$ in 1 day

$$\frac{136}{2233} \quad : \quad 1 \quad :: \quad \overset{\text{day}}{1} \quad : \quad 16\frac{57}{136} \text{ days}$$

(2)...

Quantity of bricks made in 40 weeks = $7500 \times 40 = 300000$

300000 bricks at 32*s.* 6*d.* per thousand = £487 10*s.*

	£	*s.*	*d.*
Rent of field (£5 × 11)	55	0	0
Royalty upon bricks (2*s.* × 300)	30	0	0
35 tons of coals at 11*s.* 6*d.* per ton ...	20	2	6
Wages of men (13*s.* 6*d.* ×6×40) ...162	162	0	0
Wages of boys (5*s.* 6*d.* ×6×40)	66	0	0
	£333	2	6

	£	*s.*	*d.*
Receipts	487	10	0
Expenses	333	2	6
Profit	£154	7	6

(3)...

$$\begin{array}{cc} \text{lb.} & \text{oz.} \\ 4 & 2 \\ 3 & 8 \\ \hline 10 \end{array}$$

$$10 \quad : \quad \begin{array}{cc} \text{lb.} & \text{oz.} \\ 4 & 2 \end{array} = \begin{array}{c} \text{oz.} \\ 66 \end{array} \quad :: \quad 1 \quad : \quad 6\tfrac{3}{5}$$

$$\begin{array}{cc} \text{lb.} & \text{oz.} \\ 6 & 4 \\ 5 & 6 \\ \hline 14 \end{array}$$

$$14 \quad : \quad \begin{array}{cc} \text{lb.} & \text{oz.} \\ 6 & 4 \end{array} = \begin{array}{c} \text{oz.} \\ 100 \end{array} \quad :: \quad 1 \quad : \quad 7\tfrac{1}{7}$$

$$6\tfrac{3}{5} \quad : \quad 7\tfrac{1}{7}$$

$$\tfrac{33}{5} \quad : \quad \tfrac{50}{7}$$

$$231 \quad :. \quad 250$$

(4)...

A   9 horses for 12 weeks $= 9 \times 1 \times 12 = 108$
B   12 cows for 16 weeks $= 12 \times \tfrac{3}{4} \times 16 = 115\tfrac{1}{5}$
C   45 sheep for 26 weeks $= 45 \times \tfrac{9}{100} \times 26 = 105\tfrac{3}{10}$
$$\overline{328\tfrac{1}{2}}$$

$$328\tfrac{1}{2} \quad : \quad 108 \quad :: \quad \begin{array}{cc} \pounds & s. \\ 18 & 5 \end{array} \quad : \quad \begin{array}{c} \pounds \\ 6 \end{array} \quad A$$

$$328\tfrac{1}{2} \quad : \quad 115\tfrac{1}{5} \quad :: \quad \begin{array}{cc} \pounds & s. \\ 18 & 5 \end{array} \quad : \quad \begin{array}{cc} \pounds & s. \\ 6 & 8 \end{array} \quad B$$

$$328\tfrac{1}{2} \quad : \quad 105\tfrac{3}{10} \quad :: \quad \begin{array}{cc} \pounds & s. \\ 18 & 5 \end{array} \quad : \quad \begin{array}{cc} \pounds & s. \\ 5 & 17 \end{array} \quad C$$

(5)...

$$\begin{array}{rcl} 3 \times \cdot95 &=& 2\cdot85 \\ 7 \times 1\cdot15 &=& 8\cdot05 \\ 12 \times 1\cdot36 &=& 16\cdot32 \\ \hline 22 && 27\cdot22 \end{array}$$

$$27\cdot22 \div 22 = 1\cdot2372$$

(6)...

$$\begin{array}{lr} & \begin{array}{ccc} \pounds & s. & d. \end{array} \\ \text{55 acres at 44}s.\text{ per acre} \quad \ldots\ldots = & 121 \quad 0 \quad 0 \\ \text{Expended for labour, \&c.} \quad \ldots\ldots = & 125 \quad 0 \quad 0 \\ \text{Tithes and rates (13}s.\text{ 6}d. \times 55) = & \underline{37 \quad 2 \quad 6} \\ & \pounds283 \quad 2 \quad 6 \end{array}$$

$$28 \times 55 = 1540 \text{ bushels of wheat at } 5s. \; 9d. = \begin{array}{ccc} \pounds & s. & d. \\ 442 & 15 & 0 \\ 283 & 2 & 6 \end{array}$$

Profit on the holding at 44s. per acre $= \pounds 159 \quad 12 \quad 6$

			$\pounds$	$s.$	$d.$
35 acres at 37s. 6d. per acre ...	=		65	12	6
Expended for labour, &c..........	=		63	0	0
Tithes and rates (13s. 6d. × 35)	=		23	12	6
			$\pounds 152$	5	0

	$\pounds$	$s.$	$d.$
1600 bushels of oats at 2s. 10d. =	226	13	4
	152	5	0
Profit on holding at 37s. 6d. per acre =	$\pounds 74$	8	4

$$\begin{array}{ccccccc} \pounds & s. & d. & & \pounds & s. & d. \\ 283 & 2 & 6 \end{array} : \begin{array}{ccc} 159 & 12 & 6 \end{array} :: 100 : 56\tfrac{172}{453} \text{ per cent.}$$

$$\begin{array}{cc} \pounds & s. \\ 152 & 5 \end{array} : \begin{array}{ccc} \pounds & s. & d. \\ 74 & 8 & 4 \end{array} :: 100 : 48\tfrac{1604}{1827} \text{ per cent.}$$

The land rented at 44s. per acre is therefore the more profitable occupation.

(7)...   1.   The minute-hand has to gain 3 rounds

$$\begin{array}{c} \text{ro.} \\ 11 \end{array} : \begin{array}{c} \text{ro.} \\ 3 \end{array} :: \begin{array}{c} \text{hrs.} \\ 12 \end{array} : 3 \text{ hrs. } 16 \text{ min. } 21\tfrac{9}{11} \text{ sec.}$$

2.   The minute-hand has to gain $3\frac{1}{4}$ rounds

$$\begin{array}{c} \text{ro.} \\ 11 \end{array} : \begin{array}{c} \text{ro.} \\ 3\frac{1}{4} \end{array} :: \begin{array}{c} \text{hrs.} \\ 12 \end{array} : 3 \text{ hrs. } 32 \text{ min. } 43\tfrac{7}{11} \text{ sec.}$$

3.   The minute-hand has to gain $3\frac{1}{3}$ rounds

$$\begin{array}{c} \text{ro.} \\ 11 \end{array} : \begin{array}{c} \text{ro.} \\ 3\frac{1}{3} \end{array} :: \begin{array}{c} \text{hrs.} \\ 12 \end{array} : 3 \text{ hrs. } 38 \text{ min. } 10\tfrac{10}{11} \text{ sec.}$$

4.   The minute-hand has to gain $3\frac{1}{2}$ rounds

$$\begin{array}{c} \text{ro.} \\ 11 \end{array} : \begin{array}{c} \text{ro.} \\ 3\frac{1}{2} \end{array} :: \begin{array}{c} \text{hrs.} \\ 12 \end{array} : 3 \text{ hrs. } 49 \text{ min. } 5\tfrac{5}{11} \text{ sec.}$$

(8)... 2 ac. 1 ro. 19 per. $11\frac{1}{4}$ sq. yds. = 11476 sq. yds.

$$
\begin{array}{llllll}
\text{A} & 350+ & 358+ & 366+ & 374+\&\text{c. to } n \text{ terms} \\
\text{B} & 380+ & 374+ & 368+ & 362+\&\text{c.} & \text{,,} \\
\text{C} & 320+ & 330+ & 340+ & 350+\&\text{c.} & \text{,,} \\
\text{D} & 360+ & 355+ & 350+ & 345+\&\text{c.} & \text{,,} \\
\hline
s = & \overline{1410+} & 1417+ & 1424+ & 1431+\&\text{c. to } n \text{ terms}
\end{array}
$$

$$s = \{2a+(n-1)d\}\frac{n}{2}$$

$$11476 = \{2820+(n-1)7\}\frac{n}{2}$$

or, $7n^2+2813n = 22952$

from which equation, $n = 8$, the number of days

(9)...No. of yards $= 200+160+128+102\frac{2}{5}+\&$c. in infinitum

the formula for which series is $\dfrac{a}{1-r}$

here $\dfrac{a}{1-r} = \dfrac{200}{1-\frac{4}{5}} = \dfrac{200}{\frac{1}{5}} = 1000$ yards

(10)...$4\frac{1}{2}$ per cent. on £2000000 $=\quad\overset{£}{90000}$ per annum

5 per cent. on £4000000 $=\quad 200000 \quad$,,

60 per cent. on receipts $=$ £290000 $\quad$,,

$$
\begin{array}{ccccccc}
& & & \overset{£}{} & & \overset{£}{} & \overset{s.}{} \; \overset{d.}{} \\
60 & : & 100 & :: \; 290000 & : & 483333 & 6 \quad 8
\end{array}
$$

Required weekly receipts $= \overset{£}{483333} \;\; \overset{s.}{6} \;\; \overset{d.}{8} \div 52$

$$= £9294 \; 17s. \; 5\tfrac{3}{13}d.$$

EXERCISES IN MENSURATION.

EXERCISE I.

(1)...
$$
\begin{array}{cc}
\text{sq. yds.} & \text{sq. ft.} \\
15 & 7 \\
& 9 \\
\hline
& 142 \\
& 144 \\
\hline
& 568 \\
568 & \\
142 & \\
\hline
20448 & \text{sq. inches}
\end{array}
$$

(2)...
$$
144 \left\{
\begin{array}{l}
12 \overline{)16848} \\
12 \overline{)\ 1404} \\
\quad 9 \overline{)\ 117} \\
\hline
\qquad 13 \text{ sq. yds.}
\end{array}
\right.
$$

(3)...
$$
\begin{array}{c}
43°\ 19'\ 47'' \\
60 \\
\hline
2599 \\
60 \\
\hline
155987 \text{ seconds}
\end{array}
$$

(4)...
$$24'\ 35'' = 1475 \text{ seconds}$$
$$1° = 3600 \quad \text{,,}$$
$$\tfrac{1475}{3600} \div \tfrac{25}{25} = \tfrac{59}{144} \text{ of a degree}$$

(5)...
$$
\begin{array}{l}
4\overline{)\ 3} \\
60\overline{)18\cdot 75} \\
60\overline{)25\cdot 3125} \\
\hline
\cdot 421875 \text{ of a degree}
\end{array}
$$

(6)...
$$
\begin{array}{c}
90°\ \ 0'\ \ 0'' \\
37°\ 25'\ 45'' \\
\hline
52°\ 34'\ 15''
\end{array}
$$

(7)...
$$
\begin{array}{rl}
\text{The } 3\angle\text{s} = & 180°\ \ 0' \\
55°\ 45' \times 2 = & 111°\ 30' \\
\hline
\text{Vertical } \angle = & 68°\ 30'
\end{array}
$$

(8)...
$$
\begin{array}{ccccccc}
\text{ft.} & & \text{ft.} & & \text{ft.} & & \\
6\tfrac{3}{4} & : & 8 & :: & 189 & : & x
\end{array}
$$

$$x = \frac{4}{27} \times \frac{8}{1} \times \frac{\overset{7}{\cancel{189}}}{1} = 224 \text{ feet}$$

(9)...

ft.	in.			ft.	in.		
9	7			13	8		
4	9			11	4		
38	4			150	4		
7	2	3		4	6	8	
45	6	3	= 45 sq. ft. 75 sq. in.	154	10	8	= 154 sq. ft. 128 sq. in.

(10)...

13 ft. 7′ 10″
9 ft. 8′ 3″
122   10   6
9   1   2   8
3   4   11   6
132 ft. 3′ 1″ 7‴ 6⁗

EXERCISE II.

(1)...

ft.	in.		
10	9		
4	2		
43	0		
1	9	6	
44	9	6	= 44 sq. ft. 114 sq. in.

(2)...

ft.
29
29
261
58
841 sq. ft.
144
3364
3364
841
121104 sq. in.

(3)...

sq. in.
144)45
9) 7·3125
·8125 of a sq. yd.

4840)3267·000(·675 of an acre
29040
36300
33880
24200
24200

(4)...

yds.   ft.
35 = 105
25
525
210
9)2625 sq. ft.
291 sq. yds. 6 sq. ft.

(5)...
$$\begin{array}{r} \text{ft.} \\ 24 \\ 24 \\ \hline 96 \\ 48 \\ \end{array}$$

$$18 \begin{cases} 3\overline{)576} \text{ sq. ft.} \\ 6\overline{)192} \end{cases}$$
$$\overline{32 \text{ feet}}$$

(6)...   1 acre = 4840 sq. yds.
$$\begin{array}{r} 4\frac{1}{2} \\ \hline 19360 \\ 2420 \\ \end{array}$$

$$36 \begin{cases} 6\overline{)21780} \\ 6\overline{)\ 3630} \end{cases}$$
$$\overline{605 \text{ trees}}$$

(7)... $$\overset{\text{sq. ft.}}{12\tfrac{1}{4}} \div \overset{\text{in.}}{10\tfrac{1}{2}} = \overset{\text{sq. ft.}}{12\tfrac{1}{4}} \div \overset{\text{ft.}}{\frac{7}{8}} = \frac{\overset{7}{\cancel{49}}}{\cancel{4}} \times \frac{\overset{2}{\cancel{8}}}{7} = 14 \text{ feet}$$

(8)...   Area of yard $= \overset{\text{ft.}}{87} \times \overset{\text{ft.}}{45} = \overset{\text{sq. ft.}}{3915} = \overset{\text{sq. in.}}{563760}$

Area of each tile $= 9 \times 9 = 81$ sq. in.

No. of tiles $= 563760 \div 81 = 6960$

(9)...   11 acres 16 perches = 1776 perches

Area of each allotment $= 1776 \div 32 = 55\tfrac{1}{2}$ per.

$= 1$ rood $15\tfrac{1}{2}$ per.

(10)...   Area of chess-board $= \overset{\text{in.}}{15} \times \overset{\text{in.}}{15} = 225$ sq. in.

No. of divisions $= 64$

$225 \div 64 = 3\tfrac{33}{64}$ sq. inches, area of each division

EXERCISE III.

(1)...
$$\begin{array}{rrr} 90° & 0' & 0'' \\ 27° & 25' & 38'' \\ \hline 62° & 34' & 22'' \end{array}$$

(2)...
$$\begin{array}{rr} 90° & 0' \\ 21° & 26' \\ \hline 2)68° & 34' \\ \hline 34° & 17' \end{array} \text{ smaller angle}$$

$$\begin{array}{rr} 21° & 26' \\ \hline 55° & 43' \end{array} \text{ larger angle}$$

(3)...
$$\begin{array}{rr} \text{ft.} & \text{in.} \\ 3 & 2 \\ 2 & 2 \\ \hline 6 & 4 \\ & 6 \quad 4 \\ \hline 6 \quad 10 & 4 \end{array}$$

= 6 sq. ft. 10 primes, 4 sq. in. = 6 sq. ft. 124 sq. in.
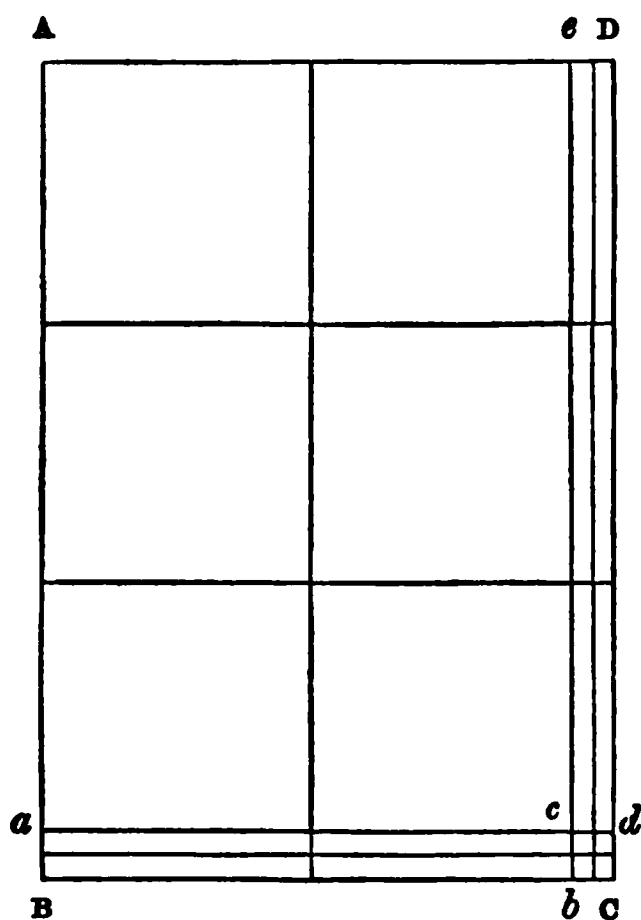
1 sq. ft. = 1 ft. × 1 ft.

1 prime = 1 ft. × 1 in. = $\frac{1}{12}$ sq. ft. = 12 sq. in.

1 sq. in. = 1 in. × 1 in.

$$\text{A}ace = 6 \text{ sq. feet}$$
$$a\text{B}bc + cd\text{D}e = 10 \text{ primes}$$
$$cb\text{C}d = 4 \text{ sq. inches}$$
$$\text{ABCD} = 6 \text{ sq. ft. 10 primes, 4 sq. in.}$$

(4)...

$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
4 & 4 \\
4 & 4 \\
\hline
17 & 4 \\
1 & 5 \quad 4 \\
\hline
18 \quad 9 & 4 = 18 \text{ sq. ft. } 112 \text{ sq. in.}
\end{array}
$$

(5)...

$$1 \text{ sq. foot} = 144 \text{ sq. inches}$$

$$144 \div 10\tfrac{1}{2} = \frac{\overset{48}{\cancel{144}}}{1} \times \frac{2}{\underset{7}{\cancel{21}}} = \frac{96}{7} = 13\tfrac{5}{7} \text{ inches}$$

(6)...

$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
22 & 8 \\
14 & 4 \\
\hline
317 & 4 \\
7 \quad 6 & 8 \\
\hline
324 \quad 10 & 8 = 324 \text{ sq. ft. } 128 \text{ sq. in.}
\end{array}
$$

(7)...

$$
\begin{array}{r}
\text{links} \\
1345 \\
880 \\
\hline
107600 \\
107600 \\
\hline
11{\cdot}83600 \text{ ac.} \\
4 \\
\hline
3{\cdot}34400 \text{ ro.} \\
40 \\
\hline
13{\cdot}76000 \text{ po.}
\end{array}
$$

11 acres, 3 roods, $13\tfrac{19}{25}$ poles

(8)...

$$
\begin{array}{ccc}
\text{in.} & \text{in.} & \text{sq. in.} \\
\text{Area of 1 sheet} = 45 \times 29\tfrac{1}{2} & = & 1327\tfrac{1}{2}
\end{array}
$$

$$
144 \left\{
\begin{array}{l}
12\overline{)31860} \\
12\overline{)\ 2655}
\end{array}
\right.
\quad
\begin{array}{r}
24 \\
\hline
\end{array}
$$

$$9\overline{)\ \ 221} \quad 3 = 36 \text{ sq. in.}$$

24 sq. yds. 5 sq. ft. 36 sq. in.

(9)... Area of lawn = 42 yds. × 32 yds. = 1344 sq. yds.
$$= 1741824 \text{ sq. in.}$$

Area of each sod = 2 ft. × 16 in. = 384 sq. in.

No. of sods = 1741824 ÷ 384 = 4536

(10)...   40 sq. ft. 12 sq. in. = 5772 sq. inches
12 ft. 4 in. = 148 inches

5772 sq. in. ÷ 148 in. = 39 in. = 3 ft. 3 in.

EXERCISE IV.

	ft.	in.
(1)...	10	6
	4	2
	42	0
	1	9
	43	9

$43\ 9 = 43\frac{3}{4}$ sq. ft.

(2)... The 3 angles contain 180°
$$2+3+4 = 9$$

9 : 2 :: 180° : 40°
9 : 3 :: 180° : 60°
9 : 4 :: 180° : 80°

(3)...   in.
13 ft. 8 in. = 164
1 ft. 4 in. = 16
984
164
2624 sq. in.

(4)...   yds.
185
121
22385 sq. yds.
4

yds.   qrs.   ⎧ 11)89540
30¼ = 121 ⎨ 11) 8140
          ⎩ 40) 740
          4) 18 20
          4 ac. 2 ro. 20 per.

(5)...   Area of square = 12 yds. × 12 yds. = 144 sq. yds.
Area of par^m = 42 ft. × 30 ft. = 1260 sq. ft. = 140 sq. yds.
Difference = 4 sq. yds

(6)... $\quad$ Area of each side $= 4\frac{1}{2} \times 4\frac{1}{2} = 20\frac{1}{4}$ (in. $\times$ in. = sq. in.)

$$\text{Surface of cube} = \overline{121\frac{1}{2}} \text{ sq. in.}$$
(with the 6 as multiplier)

(7)... Area of each plank $= 15$ ft. $\times 10$ in. $= 12\frac{1}{2}$ sq. ft.

Area of floor $= 30$ ft. $\times 22\frac{1}{2}$ ft. $= 675$ sq. ft.

No. of planks $= 675 \div 12\frac{1}{2} = 54$

(8)... 2 ro. 20 per. $= 100$ per.

(9)... $4\frac{3}{4}$ ac. $= 22990$ sq. yds.

$\sqrt{100} = 10$ per. $= 55$ yds.

$22990 \div 187 = 122\frac{16}{17}$ (sq. yds. $\div$ yds. = yds.)

(10)... Area of court $= 42 \times 42 = 1764 = 2286144$ (yds. $\times$ yds. = sq. yds. = sq. in.)

Dimensions of each tile $= 2286144 \div 28224 = 81$ sq. in.

$= 9$ inches square

EXERCISE V.

(1)...
$$\begin{array}{r} 180° \quad 0' \quad 0'' \\ 42° \quad 35' \quad 0'' \\ \hline 2)137° \quad 25' \quad 0'' \end{array}$$
Each $\angle$ at base $= 68° \ 42' \ 30''$

(2)...
$$\begin{array}{r} 875 \text{ links} \\ 750 \\ \hline 43750 \\ 6125 \\ \hline 6\cdot56250 \text{ ac.} \\ 4 \\ \hline 2\cdot25000 \text{ ro.} \\ 40 \\ \hline 10\cdot00000 \text{ per.} \end{array}$$

6 ac. 2 ro. 10 per.

(3)... 2 sq. ft. $= 288$ sq. in.

$288 \div 6\frac{3}{4} = 42\frac{2}{3}$ in. $= 3$ ft. $6\frac{2}{3}$ in.

C C

(4)...

ft.	′	″
7	8	6
7	8	6
53	11	6
5	1	8	0
	3	10	3
59ft. 5′ 0″ 3‴		

ft.	′	″
9	7	6
5	4	6
48	1	6
3	2	6
	4	9	9
51ft. 8′ 9″ 9‴		

(5)...

ft.	in.
9	8
5	3
48	4
2	5
2)50	9
25	$4\frac{1}{2}$

$25\ 4\frac{1}{2}$ = 25 sq. ft. 54 sq. in.

(6)... $272\frac{1}{4}$ = 272·25 (16·5 = $16\frac{1}{2}$ ft.

$$26)\overline{172}$$
$$156$$
$$325)\ \overline{1625}$$
$$1625$$

(7)...Area of each slate = 13 in. × $8\frac{1}{2}$ in. = $110\frac{1}{2}$ sq. in.

Area of roof = $42\frac{1}{4}$ ft. × $25\frac{1}{2}$ ft. = 155142 sq. in.

No. of slates = 155142 ÷ $110\frac{1}{2}$ = 1404

(8)...

ft.	in.	
18	8	
18	8	
336	0	
12	5	4
348	5	4

ft.	in.	
16	10	
16	10	
269	4	
14	0	4
283	4	4

sq. ft.	′	″	sq. ft.	sq. in.
348	5	4 =	348	64
283	4	4 =	283	52
Difference =			65	12

(9)...

$$\text{yds.}$$
$$4)\overline{170}$$

Side of garden $= \overline{42\cdot5}$ yards

$$42\cdot5$$
$$\overline{2125}$$
$$850$$
$$1700$$

Area of garden $= \overline{1806\cdot25} = 1806\frac{1}{4}$ sq. yds.

(10)... Area of room $= 27$ ft. $\times 21\frac{1}{4}$ ft. $= 573\frac{3}{4}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 3$ ft. $= 9$ sq. ft.

No. of yds. required $= 573\frac{3}{4} \div 9 = 63\frac{3}{4}$

EXERCISE VI.

(1)...

	ft.	′	″
8·375 yards =	25	1	6
9⅝ feet =	9	10	0
	226	1	6
	20	11	3
	247	0	9

$= 247$ sq. ft. 9 sq. in.

(2)... 225 links $= 2\frac{1}{4}$ chains $= 49\frac{1}{2}$ yards

$$49\frac{1}{2} = 49\cdot5$$
$$49\cdot5$$
$$\overline{2475}$$
$$4455$$
$$1980$$
$$\overline{2450\cdot25} = 2450\frac{1}{4} \text{ sq. yds.}$$

(3)... Area of floor $= 31\frac{1}{2}$ ft. $\times 25\frac{1}{2}$ ft. $= 803\frac{1}{4}$ sq. ft.

Area of 1 yd. drugget $= 4\frac{1}{2}$ ft. $\times 3$ ft. $= 13\frac{1}{2}$ sq. ft.

Length of drugget required $= 803\frac{1}{4} \div 13\frac{1}{2} = 59\frac{1}{2}$ yds.

(4)... See Appendix, page 178.

Area of square $= \dfrac{35 \times 35}{2} = 612\frac{1}{2}$ square yards

c c 2

(5)... Area of rectangle $= 18$ ft. $\times 12$ ft. $= 216$ sq. ft.

Side of square $= \sqrt{216} = 14\cdot69$ ft.

(6)...

$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
7 & 6 \\
4 & 3 \\
\hline
30 & 0 \\
1 \;\; 10 & 6 \\
\hline
\end{array}
$$

Area of door $= 31\ 10\ 6 = 31\tfrac{7}{8}$ sq. ft.

$$
\begin{array}{ccccccc}
\text{sq. ft.} & & \text{sq. ft.} & & d. & & \\
9 & : & 31\tfrac{7}{8} & :: & 15 & : & x
\end{array}
$$

$$
x = \frac{1}{\cancel{9}} \times \frac{\cancel{255}^{\,85}}{8} \times \frac{\cancel{15}^{\,5}}{1} = \frac{425}{8}d. = 4s.\ 5\tfrac{1}{8}d.
$$

(7)... 3 acres 1 rood 4 poles 25 yards $= 15876$ sq. yds.

Side of field $= \sqrt{15876} = 126$ yds.

(8)..

$$
\begin{array}{rr}
& \text{yds.} \\
\tfrac{3}{4} \text{ mile} = & 1320 \\
48 \text{ feet} = & 16 \\
\hline
\text{Area of street} = & 21120 \text{ sq. yds.}
\end{array}
$$

$$
\begin{array}{ll}
1s.\ 8d. = \tfrac{1}{12} \text{ of } \pounds 1 & \left|\ 21120 \right. \\
1d. = \tfrac{1}{20} \text{ of } 1s.\ 8d. & \left|\ \overline{1760} \right. \\
& \left|\ 88 \right. \\
& \overline{\pounds 1848}
\end{array}
$$

(9)...

$$
\begin{array}{rcl}
7^2 &=& 49 \\
9^2 &=& 81 \\
11^2 &=& 121 \\
\end{array}
$$

Area of 3 given squares $= 251$ sq. yds.

Side of required square $= \sqrt{251} = 15\cdot8429$ yds.

(10)... Area of floor $= 27\frac{1}{2}$ ft. $\times 20\frac{1}{4}$ ft. $= 556\frac{7}{8}$ sq. ft.

Area of 1 yd. carpeting $= 2\frac{1}{4}$ ft. $\times 3$ ft. $= 6\frac{3}{4}$ sq. ft.

Carpeting required $= 556\frac{7}{8} \div 6\frac{3}{4} = 82\frac{1}{2}$ yds.

EXERCISE VII.

(1)...
$$1+2+2 = 5$$

3 angles of triangle $= 180°$

$$\text{Vertical angle} = \frac{5)180°}{36°}$$

$$\text{Each angle at base} = \frac{2}{72°}$$

(2)...
ft.	in.
18	6
12	8
222	0
12	4
2)234	4
117	2

$= 117$ sq. ft. 24 sq. in.

(3)...
ft.	′	″
17	5	8
9	4	3
157	3	0
5	9 10	8
	4 4	5

163 ft. $5′$ $3″$ $1‴$

(4)...
ft.	in.
5	10
2	6
11	8
2	11

Area of slab $= 14 \quad 7 = 14\frac{7}{12}$ sq. ft.

$14\frac{7}{12}$ sq. ft. at 3s. 6d. per foot $= £2$ 11s. $0\frac{1}{2}d.$

(5)...Area of yard $= 69$ ft. $\times 24$ ft. $= 1656$ sq. ft. $= 238464$ sq. in.

Area of each brick $= 9$ in. $\times 4\frac{1}{2} = 40\frac{1}{2}$ sq. in.

No. of bricks required $= 238464 \div 40\frac{1}{2} = 5888$

(6)...

$$\begin{array}{cc} \text{ft.} & \text{in.} \\ 10 & 9 \\ 1 & 4 \\ \hline 10 & 9 \\ 3 & 7 \\ \hline \end{array}$$

Area of plank $= \overline{14 \quad 4} = 14\frac{1}{3}$ sq. ft.

$14\frac{1}{3}$ sq. ft. at 1s. 6d. per foot $= £1$ 1s. 6d.

(7)...

$$(12\frac{1}{4})^3 \div (1\frac{3}{4})^3 = \frac{\cancel{49}^{7}}{\cancel{4}} \times \frac{\cancel{49}^{7}}{\cancel{4}} \times \frac{\cancel{49}^{7}}{\cancel{4}} \times \frac{\cancel{4}}{\cancel{7}} \times \frac{\cancel{4}}{\cancel{7}} \times \frac{\cancel{4}}{\cancel{7}}$$

$$= 343 \text{ cubes}$$

(8)...

$$\begin{array}{cc} \text{ft.} & \text{in.} \\ 8 & 3 \\ 4 & 2 \\ \hline 33 & 0 \\ 1 & 4 \quad 6 \\ \hline \end{array}$$

Area of door $= \overline{34 \quad 4 \quad 6} = 34\frac{3}{8}$ sq. ft.

$34\frac{3}{8}$ sq. ft. at 1s. 6d. per foot $= £2$ 11s. $6\frac{3}{4}d.$

(9)...　Area of floor $= 21\frac{1}{2}$ ft. $\times 16\frac{2}{3}$ ft. $= 358\frac{1}{3}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 3$ ft. $= 9$ sq. ft.

Carpeting required $= 358\frac{1}{3} \div 9 = 39\frac{22}{27}$ yds.

$39\frac{22}{27}$ yds. at 4s. 6d. per yd. $= £8$ 19s. 2d.

(10)...

$$\begin{array}{ccccccccc} \text{sq. yds.} & & \text{yds.} & \text{yds.} & & \text{s.} & \text{d.} & & \\ 4840 & : & 192 & \times 168 & :: & 13 & 9 & : & x \\ & & & & & 12 & & & \\ \hline & & & & & 165 & & & \end{array}$$

$$x = \frac{\overset{24}{\cancel{192}} \times 168 \times \overset{3}{\cancel{165}}}{\underset{\underset{11}{\cancel{605}}}{\cancel{4840}}} = \frac{12096}{11} = £4 \text{ 11s. } 7\frac{7}{11}d.$$

EXERCISE VIII.

(1)...A *trapezium* is a plane figure, having 4 unequal sides, no two of which are parallel.

A *trapezoid* is a plane four-sided figure, having two of its opposite sides parallel.

For rules for finding the areas, see Appendix, page 179.

$$
\begin{array}{r}
& \text{ft.} \quad \text{in.} \\
(2)\ldots \qquad 49 \text{ yds.} = & 147 \quad 0 \\
9 \text{ ft. } 6 \text{ in.} + 13 \text{ ft. } 10 \text{ in.} = & 23 \quad 4 \\
\hline
& 3381 \quad 0 \\
& 49 \quad 0 \\
\hline
2)& 3430 \quad 0 \\
\hline
9)& 1715 \quad 0 \\
\hline
& 190 \text{ sq. yds. } 5 \text{ sq. ft.}
\end{array}
$$

$$
\begin{array}{r}
& \text{ft.} \quad \text{in.} \\
(3)\ldots \qquad 19 \text{ ft.} + 23 \text{ ft.} = & 42 \quad 0 \\
& 9 \quad 8 \\
\hline
& 378 \quad 0 \\
& 28 \quad 0 \\
\hline
2)& 406 \quad 0 \\
\hline
& 203 \text{ sq. ft.}
\end{array}
$$

$$
\begin{array}{r}
\text{ft.} \quad ' \quad '' \\
(4)\ldots \qquad 96 \quad 10 \quad 0 \\
23 \quad 4 \quad 6 \\
\hline
2227 \quad 2 \quad 0 \\
32 \quad 3 \quad 4 \\
4 \quad 0 \quad 5 \\
\hline
2)2263 \quad 5 \quad 9 \\
\hline
1131 \quad 8 \quad 10\tfrac{1}{2} = 1131 \text{ sq. ft. } 106\tfrac{1}{2} \text{ sq. in.}
\end{array}
$$

(5)... $\quad 684$ cu. in. $= \frac{684}{1728} + \frac{36}{36} = \frac{19}{48}$ of a cubic foot

12 cu. ft. 432 cu. in. $= 21168$ cu. in.

1 cu. yd. $= 46656$ cu. in.

$\frac{21168}{46656} + \frac{432}{432} = \frac{49}{108}$ of a cubic yard

(6)...

$$40)\overline{21}$$
$$27)\overline{15\cdot525}$$

$15\frac{21}{40}$ cu. ft. $=$ ·575 of a cubic yard

(7)...

$$18 \text{ ft.} = 216 \text{ in.}$$
$$\underline{15}$$
$$\overline{3240}$$
$$\underline{10}$$
$$1728)\overline{32400}(18 \text{ cu. ft. } 1296 \text{ cu. in.}$$
$$\underline{1728}$$
$$\overline{15120}$$
$$\underline{13824}$$
$$\overline{1296} \text{ cu. in.}$$

(8)...

$$4 \text{ ft. } 2 \text{ in.} = 50 \text{ in.}$$
$$\underline{50}$$
$$\overline{2500}$$
$$\underline{2}$$
$$\overline{5000}(70\cdot71 \text{ in.} = 5 \text{ ft. } 10\cdot71 \text{ in.}$$
$$\underline{49}$$
$$1407)\overline{10000}$$
$$\underline{9849}$$
$$14141)\overline{15100}$$
$$\underline{14141}$$
$$\overline{959}$$

(9)...

ft.	in.	
2	7	
2	7	
5	2	
1	6	1
6	8	1
2	7	
13	4	2
3	10	8 7
17	2	10 7

$=17$ cu. ft. 415 cu. in.

$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
21 & 9 \\
16 & 8 \\
\hline
348 & 0 \\
14 & 6 \\
\hline
362 & 6 \\
\end{array}
\qquad
\begin{array}{cc}
\text{ft.} & \text{in.} \\
17 & 6 \\
12 & 10 \\
\hline
210 & 0 \\
14 & 7 \\
\hline
224 & 7 \\
\end{array}
$$

(10)...

$$
\begin{array}{rcc}
 & \text{sq. ft.} & ' \\
\text{Area of floor} = & 362 & 6 \\
\text{Area of carpet} = & 224 & 7 \\
\hline
\text{Portion of floor uncovered} = & 137 & 11 = 137 \text{ sq. ft. } 132 \text{ sq. in}
\end{array}
$$

EXERCISE IX.

(1)...

$$
\begin{array}{l}
90° \\
54\cdot375° \\
\hline
35\cdot625° = 35° \ 37' \ 30'' \\
\quad 60 \\
\hline
\quad 37\cdot500' \\
\qquad 60 \\
\hline
\qquad 30\cdot000'' \\
\end{array}
$$

(2)...

$$
\begin{array}{l}
\text{yds.} \\
112 \\
\ 180 \\
\hline
2)20160 \\
\hline
\ 10080 \text{ sq. yds.} \\
\qquad 4 \\
\end{array}
$$

$$
\begin{array}{l}
\text{yds.} \qquad \text{qrs.} \\
30\tfrac{1}{4} = 121 \left\{ \begin{array}{l} 11)\overline{40320} \\ 11)\overline{3665 \ \ 5} \\ \overline{40)333 \ \ 2} \\ \end{array} \right\} 27 \text{ qrs.} = 6\tfrac{3}{4} \text{ yds.} \\
\qquad\qquad\qquad \overline{4)8 \ 13} \\
\qquad\qquad\qquad\quad \overline{2 \text{ ac. } 13 \text{ po. } 6\tfrac{3}{4} \text{ sq. yds.}}
\end{array}
$$

	yds.			ft.	in.
(3)...	116	(4)...	6	9

(3)...
yds.
116
116
‾‾‾‾‾
13456
2
‾‾‾‾‾
26912(164·0487 yds.
1
26)169
156
324) 1312
1269
32804) 160000
131216
328088) 2878400
2624704
3280967) 25369600
22966769
‾‾‾‾‾‾‾
2402831

(4)...
ft. in.
6 9
3 4
‾‾‾‾
20 3
2 3
‾‾‾‾
22 6
2 3
‾‾‾‾
45 0
5 7 6
‾‾‾‾‾‾
50 7 6 = 50 cu. ft. 1080 cu. in.

(5)...   34 sq. yds. 2 sq. ft. = 308 sq. ft.

18 ft. 8 in. = $18\frac{2}{3}$ ft.

$$\underset{\text{sq. ft.}}{308} \div \underset{\text{ft.}}{18\frac{2}{3}} = \frac{\overset{11}{\cancel{308}}}{1} \times \frac{3}{\underset{2}{\cancel{56}}} = \frac{33}{2} \text{ ft.} = 16 \text{ ft. } 6 \text{ in.}$$

(6)...   14 ft. × $10\frac{1}{2}$ in. × 28 = 343 sq. ft.

343 sq. ft. at $6\frac{1}{2}d$. per foot = £9 5s. $9\frac{1}{2}d$.

(7)...See Appendix, page 178.

52   94 − 52 = 42
64   94 − 64 = 30
72   94 − 72 = 22
2)188
‾‾‾‾
94

94 × 42 × 30 × 22 = 2605680

Area of garden = $\sqrt{2605680}$ = 1614·2118 sq. yds.

(8)...

$$
\begin{array}{rr}
\text{ft.} & \text{in.} \\
73 & 6 \\
29 & 3 \\
\hline
2131 & 6 \\
18 & 4\ \ 6 \\
\hline
2149 & 10\ \ 6 = 2149\tfrac{7}{8}\ \text{sq. ft.}
\end{array}
$$

$$
\begin{array}{ccccccc}
\text{sq. ft.} & & \text{sq. ft.} & & \pounds & & \\
9 & : & 2149\tfrac{7}{8} & :: & \tfrac{1}{8} & : & x
\end{array}
$$

$$
x = \frac{1}{\overset{}{9}} \times \frac{\overset{637}{\cancel{1911}}}{\underset{}{8}}\,\overset{17199}{} \times \frac{1}{\underset{2}{\cancel{6}}} = \pounds\frac{637}{16} = \pounds39\ 16s.\ 3d.
$$

(9)...

$$
\begin{array}{rll}
\text{ch.} & \text{li.} & \text{ch.} \\
7 & 75 & = 7\cdot75 \\
5 & 25 & = 5\cdot25 \\
\hline
& & 3875 \\
& & 1550 \\
& & 3875 \\
\hline
\end{array}
$$

$$10)\overline{40\cdot6875}\ \text{sq. chains}$$

$$\overline{4\cdot06875}\ \text{ac.}$$

$$\underline{\ \ \ 4}$$

$$\overline{0\cdot27500}\ \text{ro.}$$

$$\underline{\ \ 40}$$

$$\overline{11\cdot00000}\ \text{per.}$$

Area of field, 4 acres 11 perches

(10)...

$$
\begin{array}{ccccccccc}
\text{sq. yds.} & & \text{yds.} & \text{yds.} & & s. & d. & & \\
4840 & : & 300 \times & 121 & :: & 12 & 6 & : & x \\
& & & & & 12 & & & \\
\cline{6-6}
& & & & & 150 & & &
\end{array}
$$

$$
x = \frac{\overset{15}{\cancel{300}} \times \overset{75}{\cancel{121}} \times \cancel{150}}{\underset{\underset{\underset{2}{\cancel{40}}}{\cancel{40}}}{\cancel{4840}}} = 1125d. = \pounds4\ 13s.\ 9d.
$$

EXERCISE X.

(1)...An *arc* of a circle is any part of the circumference.

A *chord* is a straight line joining the extremities of an arc.

A *radius* of a circle is a straight line drawn from the centre to the circumference.

A *segment* of a circle is a figure contained by a straight line and the part of the circumference which it cuts off; or, more briefly, by an arc and its chord.

A *sector* of a circle is a figure contained by two radii and the included arc.

A *semicircle* is both a *segment* and a *sector*.

(2)...Diameter of circle : circumference of circle :: 1 : 3·1416

$$\begin{array}{r} 3\cdot 1416 \\ \text{Diameter of circle} = \underline{\hspace{0.5cm}11}\ \text{ft.} \\ \text{Circumference of circle} = \overline{34\cdot 5576}\ \text{ft.} \end{array}$$

(3)...See "*Answers.*"

(4)...See Appendix, page 179, and "*Answers.*"

(5)...   Diameter of circle = 4 ft. 8 in. = $4\frac{2}{3}$ ft.

Circumference = $3\cdot 1416 \times 4\frac{2}{3} = 14\cdot 6608$ ft.

Area = $\cdot 7854 \times (4\frac{2}{3})^2 = 17\cdot 1042$ sq. ft.

(6)...Circumference of circle = $3\cdot 1416 \times 56 = 175\cdot 9296$ yds.

$72° = \frac{1}{5}$ of circumference

∴ length of arc of 72° = 175·9296 ÷ 5

= 35·18592 yds.

(7)... $AD^2 = AB^2 - BD^2$

$= 400 - 144$

$= 256$

$\therefore AD = 16$ ft.
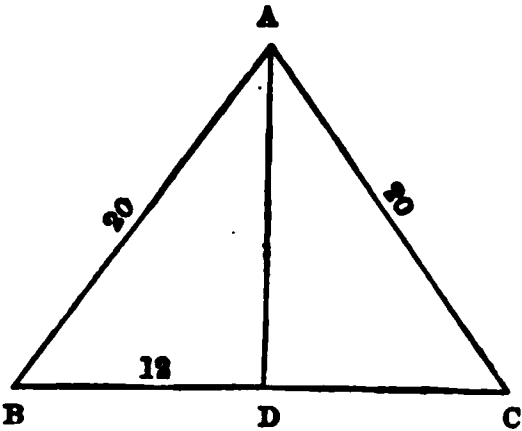
Area of triangle $= AD \times BD$

$= 16$ ft. $\times 12$ ft.

$= 192$ sq. ft.

Or thus,

24	$32 - 24 = 8$
20	$32 - 20 = 12$
20	$32 - 20 = 12$

$2\overline{)64}$

32

$32 \times 8 \times 12 \times 12 = 36864$

Area of triangle $= \sqrt{36864} = 192$ sq. ft.

(8)... $AC^2 = AB^2 + BC^2$

$= (219)^2 + (292)^2$

$= 47961 + 85264$

$= 133225$

$\therefore AC = \sqrt{133225}$

$= 365$ yds.
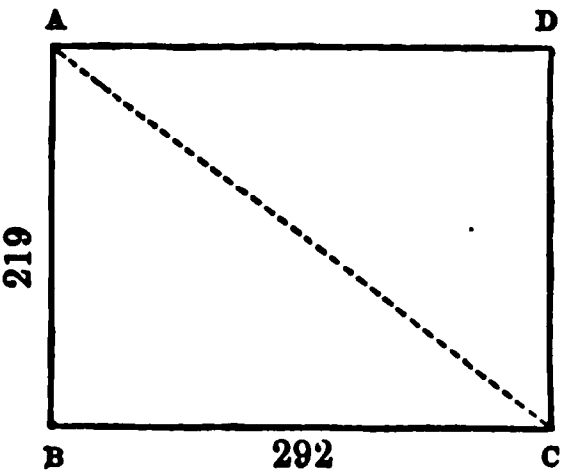
(9)...

ft.	in.	ft.	in.	ft.	in.	ft.	ft.	ft.
18	9	$\times 16$	4	$\times 10$	8	$= 18\frac{3}{4}$	$\times 16\frac{1}{3}$	$\times 10\frac{2}{3}$

$= 3266\frac{2}{3}$ cu. ft.

(10)...

$$2\tfrac{1}{2} \text{ acres} = 12100 \text{ sq. yds.}$$

$$\text{Side of field} = \sqrt{12100} = 110 \text{ yds.}$$

$$\text{Perimeter of field} = 110 \times 4 = 440 \text{ yds.}$$

$$440 \text{ yds. at } 15d. \text{ per yard} = £27 \ 10s.$$

EXERCISE XI.

(1)...

```
              links
              2775
              1025
             ‾‾‾‾‾‾
             13875
              5550
             2775
         2)2844375
          ‾‾‾‾‾‾‾‾‾‾
          14·22187½ ac.
                 4
         ‾‾‾‾‾‾‾‾‾‾
          0·88750 ro.
                40
         ‾‾‾‾‾‾‾‾‾‾
         35·50000 per.
```

Area of field, 14 acres, 35½ perches

(2)...

```
              ft.
            41·625
            16·875
           ‾‾‾‾‾‾‾‾
            208125
            291375
            333000
            249750
            41625
         2)702·421875
          ‾‾‾‾‾‾‾‾‾‾‾‾
         9)351·2109375
          ‾‾‾‾‾‾‾‾‾‾‾‾
            39·0234375 sq. yds.
```

(3)...

$$\begin{array}{cc} \text{ft.} & \text{in.} \\ 12 & 6 \\ 1 & 4 \\ \hline 12 & 6 \\ 4 & 2 \\ \hline 16 & 8 \end{array} = 16\tfrac{2}{3} \text{ sq. ft.}$$

$16\tfrac{2}{3}$ sq. ft. at 1s. 9d. per foot = £1 9s. 2d.

(4)...

$$\begin{array}{r} \overset{\text{ft.}}{(11\tfrac{1}{4})^2} = \overset{\text{ft.}}{(11\cdot25)^2} = 126\cdot5625 \\ (6\tfrac{3}{4})^2 = (6\cdot75)^2 = 45\cdot5625 \\ \hline 81 \end{array}$$

Perpendicular of triangle = $\sqrt{81}$ = 9 ft.

(5)...

$$\begin{array}{r} \cdot7854 \\ (32)^2 = 1024 \\ \hline 31416 \\ 15708 \\ 7854 \\ \hline 9)804\cdot2496 \end{array}$$

Area of enclosure = 89·3610 sq. yds.

(6)... Circumference of wheel = $\overset{\text{ft.}}{5280} \div 352$ = 15 ft.

Radius of wheel = $\overset{\text{ft.}}{15} \div 6\cdot2832$ = 2·387318 ft.

(7)...Area of each side of cube = $73\tfrac{1}{2} \div 6$ = $12\tfrac{1}{4}$ sq. in.

Edge of cube = $\sqrt{12\tfrac{1}{4}}$ = $3\tfrac{1}{2}$ in.

(8)...

$$25 \text{ ft.} + 32 \text{ ft.} = 57 \text{ ft.} = \begin{array}{r} \text{yds.} \\ 84 \\ 19 \\ \hline 2)1596 \\ \hline 798 \text{ sq. yds.} \end{array}$$

(9)...   Area of floor $= 27\frac{1}{2}$ ft. $\times 22\frac{1}{2}$ ft. $= 618\frac{3}{4}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 2\frac{1}{2}$ ft. $= 7\frac{1}{2}$ sq. ft.

Carpeting required $= 618\frac{3}{4} \div 7\frac{1}{2} = 82\frac{1}{2}$ yds.

$82\frac{1}{2}$ yds. at $3s.$ $9d.$ per yard $= £15$ $9s.$ $4\frac{1}{2}d.$

(10)...

$$
\begin{array}{r}
200 \\
300 \\
400 \\
\hline
2\,)\,\overline{900} \\
\hline
450
\end{array}
\qquad
\begin{array}{l}
450 - 200 = 250 \\
450 - 300 = 150 \\
450 - 400 = 50
\end{array}
$$

$450 \times 250 \times 150 \times 50 = 843750000$

$\overline{\sqrt{843750000}} = 29047$ sq. yds. $= 6$ acres, 7 sq. yds.

EXERCISE XII.

(1)...   Area of floor $= \overset{\text{yds.}}{27\frac{1}{2}} \times \overset{\text{yds.}}{20\frac{1}{4}} = \overset{\text{sq. yds.}}{556\frac{7}{8}} = \overset{\text{sq. in.}}{721710}$

Area of each brick $= 9$ in. $\times 4\frac{1}{2}$ in. $= 40\frac{1}{2}$ sq. in.

No. of bricks required $= 721710 \div 40\frac{1}{2} = 17820$
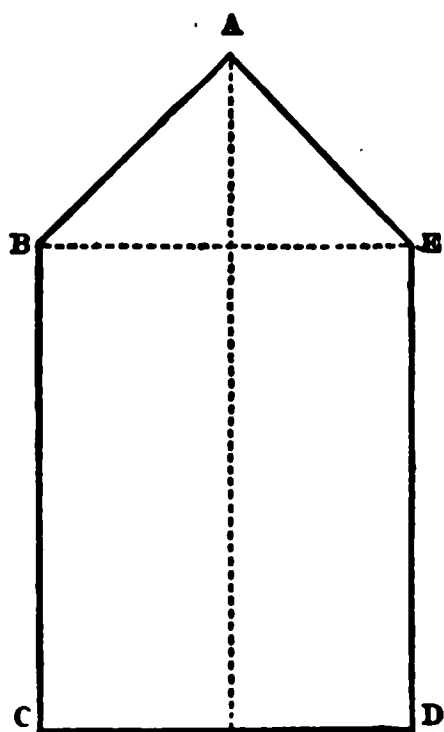
(2)...   Area of ABE $= \frac{1}{2}(32 \times 16)$

$= 256$ sq. ft.

Area of BCDE $= 40 \times 32$

$= 1280$ sq. ft.

Area of ABCDE $= 256 + 1280$

$= 1536$ sq. ft.

$= 170\frac{2}{3}$ sq. yds.

(3)...

$$22\tfrac{2}{5} + 10\tfrac{1}{2} = 22\tfrac{2}{5} \div \tfrac{7}{8} = \frac{\overset{16}{\cancel{112}}}{5} \times \frac{8}{7} = \frac{128}{5}\,\text{ft.} = 25\tfrac{3}{5}\,\text{feet}$$

sq. ft. in.   sq. ft. ft.

(4)...

ch.	li.	ch.
17	45	= 17·45
10	16	= 10·16

10470
1745
1745
10)177·2920 sq. chains
17·7292 ac.
4
2·9168 ro.
40
36·6720 per.

Area of field = 17 ac. 2 ro. 36·672 per.

(5)... Area of roof = 37$\tfrac{2}{3}$ ft. × 25$\tfrac{1}{2}$ ft. = 960$\tfrac{1}{2}$ sq. ft.
Weight of lead = 960$\tfrac{1}{2}$ × 6$\tfrac{1}{4}$ = 6003$\tfrac{1}{8}$ lb.
= 2 tons, 13 cwt. 2 qrs. 11$\tfrac{1}{8}$ lb.

(6)...

$$AD^2 = AB^2 - BD^2$$
$$= 144 - 36$$
$$= 108$$

$$\therefore AD = \sqrt{108}$$
$$= 10\cdot3923 \text{ feet}$$
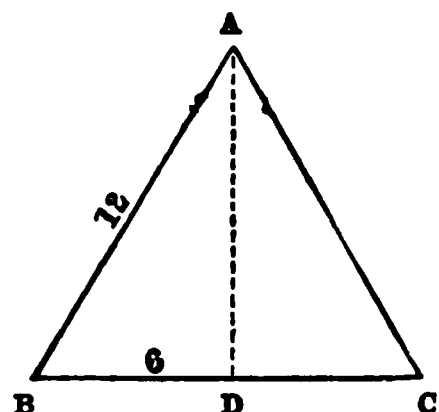
Area of triangle ABC = AD × BD
= 10·3923 ft. × 6 ft.
= 62·3538 sq. ft.

thus, 12
12
12
2)36
18

18 − 12 = 6

18 × 6 × 6 × 6 = 3888

Area of triangle = $\sqrt{3888}$
= 62·3538 sq. ft.

D D

(7)...   125 yds. × 13 ft. = 541⅔ sq. yds. = 17 po. 27$\frac{5}{12}$ sq. yds.

	ac.	ro.	po.	yds.
Area of plantation ...	17	0	0	0
Area of carriage-drive	0	0	17	27$\frac{5}{12}$
	16 a.	3 r.	22 p.	2⅚ yds.

(8)...   181 sq. ft. 36 sq. in. = 26100 sq. in.

21 ft. 9 in. = 261 in.

Height of triangle = (26100÷261)×2 = 200 in. = 16 ft. 8 in.

(9)...

ft.	in.
7	6
3	6
22	6
3	9
26	3
	2
52	6

= 52½ sq. ft. = 5⅚ sq. yds.

5⅚ sq. yds. at 9d. per yd. = 4s. 4½d.

(10)...   12 yds. 1 ft. 1½ in. = 12⅜ yds.

Area of ground = (12⅜ yds.)² = 153$\frac{9}{64}$ sq. yds. = 153·140625 sq. yds.

1 acre = 4840)153·140625(·031640625 of an acre sq. yds. sq. yds.

```
            14520
            ─────
             7940
             4840
             ────
            31006
            29040
            ─────
             19662
             19360
             ─────
              30250
              29040
              ─────
               12100
                9680
               ─────
               24200
               24200
               ─────
```

EXERCISE XIII.

(1)...
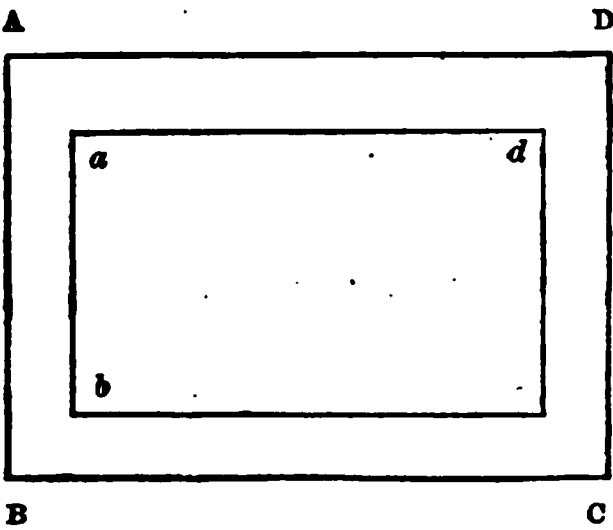
Area of frame $=$ ABCD$-abcd$

$= (38 \times 26) - (30 \times 18)$

$= 988 - 540$

$= 448$ sq. in.

$= 3$ sq. ft. 16 sq. in.

(2)...

450	$900 - 450 = 450$
600	$900 - 600 = 300$
750	$900 - 750 = 150$
2)1800	
900	

$900 \times 450 \times 300 \times 150 = 18225000000$

$\sqrt{18225000000} = 135000$ sq. links $= 1$ ac. 1 ro. 16 per.

(3)...

$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
3 & 9 \\
2 & 3 \\
\hline
7 & 6 \\
11 & 3 \\
\end{array}
$$

Area of each pane $\overline{8 \quad 5 \quad 3}$

8

Area of window $\overline{67 \quad 6 \quad 0} = 67\frac{1}{2}$ sq. ft.

$67\frac{1}{2}$ sq. ft. at 2s. 9d. per foot $= £9$ 5s. $7\frac{1}{2}d.$

D D 2

(4)...   Area of floor $= 19\frac{1}{2}$ ft. $\times 16\frac{1}{2}$ ft. $= 321\frac{3}{4}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 1\frac{5}{8}$ ft. $= 5\frac{1}{2}$ sq. ft.

Carpeting required $= 321\frac{3}{4} \div 5\frac{1}{2} = 58\frac{1}{2}$ yds.

$58\frac{1}{2}$ yds. at 4s. 9d. per yd. $= £13$ 17s. $10\frac{1}{2}d$.

(5)...   Contents of wall $= 175$ yds. $\times 12$ ft. $\times 1$ ft. $10\frac{1}{2}$ in.

$= 6300$ in. $\times 144$ in. $\times 22\frac{1}{2}$ in.

$= 20412000$ cu. in.

Contents of each brick $= 9$ in. $\times 4\frac{1}{2}$ in. $\times 3$ in. $= 121\frac{1}{2}$ cu. in.

No. of bricks required $= 20412000 \div 121\frac{1}{2} = 168000$

(6)...   Contents of block $= 18$ ft. $\times 2\frac{1}{4}$ ft. $\times 1\frac{2}{3}$ ft. $= 67\frac{1}{2}$ cu. ft.

$2\frac{1}{4}$ ft. $\times 1\frac{2}{4}$ ft. $= 4\frac{3}{8}$ sq. ft.

$$67\frac{1}{2} \text{ cu. ft.} \div 4\frac{3}{8} \text{ sq. ft.} = \frac{\overset{27}{\cancel{135}}}{\cancel{2}} \times \frac{\overset{4}{\cancel{8}}}{\underset{7}{\cancel{35}}} = \frac{108}{7} = 15\frac{3}{7} \text{ ft.}$$

(7)...

$$\overset{\text{sq. yds.}}{4840} \quad : \quad \overset{\text{yds. yds.}}{75 \times 68} \quad :: \quad \overset{£}{75} \quad : \quad x$$

$$x = \frac{\overset{15}{\cancel{75}} \times \overset{17}{\cancel{68}} \times 75}{\underset{\underset{242}{968}}{\cancel{4840}}} = £\frac{19125}{242} = £79 \text{ 0s. } 6\frac{114}{121}d.$$

(8)...

$$\overset{\text{ft.}}{(12\frac{1}{2})^2} = \overset{\text{sq. ft.}}{156\cdot25}$$

$$\overset{\text{sq. ft.}}{156\cdot25} \times \cdot7854 = 122\cdot71875 \text{ sq. ft.}$$

$$= 122 \text{ sq. ft. } 103\frac{1}{2} \text{ sq. in.}$$

(9)... £6 16s. 1½d.+6d. = 272¼ sq. yds. = area of yard

$$\sqrt{272\tfrac{1}{4}} = \sqrt{\tfrac{1089}{4}} = \tfrac{33}{2} = 16\tfrac{1}{2} \text{ yds., length of side}$$

(10)...
$$36^2 = 1296$$
$$34^2 = 1156$$
$$\overline{140}$$

$\sqrt{140} = 11\cdot832$ ft., distance of foot of ladder from building

EXERCISE XIV.

(1)...
$$\begin{array}{ccc} \text{ft. in.} & \text{in.} \\ (7\ 1)^2 = (85)^2 = 7225 \\ (5\ 8)^2 = (68)^2 = 4624 \\ \hline \overline{2601} \end{array}$$

Perpendicular $= \sqrt{2601} = 51$ in. $= 4$ ft. 3 in.

$$\begin{array}{rr} \text{ft.} & \text{in.} \\ 5 & 8 \\ 4 & 3 \\ \hline 22 & 8 \\ 1 & 5 \\ \hline 2)24 & 1 \end{array}$$

Area of triangle $= 12\ \ 0\ \ 6 = 12$ sq. ft. 6 sq. in.

(2).. Area of roof $=$ ft. in. ft. in. in. in. sq. in.
$38\ 6 \times 23\ 4 = 462 \times 280 = 129360$

Area of each slate $= 14$ in. $\times 10$ in. $= 140$ sq. in.

No. of slates required $= 129360 \div 140 = 924$

$$\begin{array}{cccc} \text{sl.} & \text{sl.} & £\ s. & £\ s.\ d. \\ 1000 & : 924 & :: 3\ 3 & : 2\ 18\ 2\tfrac{68}{125} \end{array}$$

(3)...

$$
\begin{array}{rrr}
\text{ft.} & \text{in.} & \\
8 & 4 & \\
3 & 10 & \\
\hline
25 & 0 & \\
6 & 11 & 4 \\
\hline
31 & 11 & 4 \\
3 & 3 & \\
\hline
95 & 10 & 0 \\
7 & 11 & 10 \\
\hline
103 & 9 & 10 \\
\end{array}
= 103 \text{ cu. ft. } 1416 \text{ cu. in.}
$$

(4)...   Area of field $= \frac{1}{2}(144 \times 144) = 10368$ sq. yds.

Length of side $= \sqrt{10368} = 101\cdot8233$ yds.

(5)...   Area of field $= \frac{1}{2}(150 \times 150) = 11250$ sq. yds.

$= 2$ ac. 1 ro. 11 per. $27\frac{1}{4}$ sq. yds.
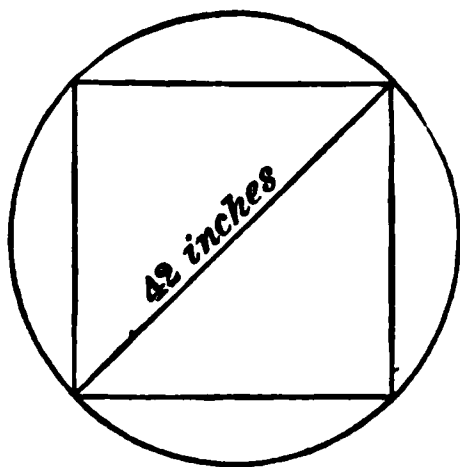
(6)...The diameter of the circle is the diagonal of the square, and is therefore equal to the side of a square double the size of the inscribed square.

Hence, the area of the inscribed square

$= \frac{1}{2}(42 \times 42) = 882$ sq. in.

Area of the circle $= (42)^2 \times \cdot7854$

$= 1385\cdot4456$ sq. in.

∴ the area of the remainder $= 503\cdot4456$ sq. in.

(7)... See Appendix, page 179.

$$\begin{array}{ccc} \text{ft.} \quad \text{in.} & & \text{ft.} \quad \text{in.} \\ (3 \quad 6)^2 & : & (5 \quad 10)^2 \\ 42^2 & : & 70^2 \\ \cancel{42} \times \cancel{42} & : & \cancel{70} \times \cancel{70} \\ 3 \times 3 & : & 5 \times 5 \\ 9 & : & 25 \end{array}$$

(8)...Contents of block $= 3$ ft. $\times 2$ ft. $\times 18$ in. $= 9$ cu. ft.

$$= 15552 \text{ cu. in.}$$

Contents of each required cube $= 3^3 = 27$ cu. in.

No. of cubes $= 15552 \div 27 = 576$

(9)...
$$\begin{array}{rr} \text{ft.} & \text{in.} \\ 22 & 6 \\ 16 & 6 \\ \hline 39 & 0 \\ & 2 \\ \hline \end{array}$$

Perimeter of room $= \overline{78 \quad 0}$
Height of room $= 11 \quad 3$

$$\begin{array}{rr} \hline 858 & 0 \\ 19 & 6 \\ \hline \end{array}$$

Area of walls $= \overline{877 \quad 6} = 877\frac{1}{2}$ sq. ft. $= 97\frac{1}{2}$ sq. yds.

$97\frac{1}{2}$ sq. yds. at $7\frac{1}{2}d.$ per yd. $= £3$ 0s. $11\frac{1}{4}d.$

(10)... $12\frac{1}{2}$ ft. $\times 5$ ft. $\times 6\frac{1}{2}$ ft. $= 406\frac{1}{4}$ cu. ft.

EXERCISE XV.

(1)...
Area of rectangular field $= 504$ yds. $\times 126$ yds. $= 63504$ sq. yds.

Side of square field $= \sqrt{63504} = 252$ yds.

(2)...

$$
\begin{array}{r}
\text{ft.} \quad \text{ft.} \quad\quad \text{ft.} \quad \text{in.} \\
19 + 23 = 42 \quad 0 \\
7 \quad 6 \\
\hline
294 \quad 0 \\
21 \quad 0 \\
\hline
2)315 \quad 0 \\
\hline
157 \quad 6 = 157\tfrac{1}{2} \text{ sq. ft.}
\end{array}
$$

(3)...

$$
\begin{array}{r}
68^2 = 4624 \\
51^2 = 2601 \\
\hline
7225
\end{array}
$$

Diagonal $= \sqrt{7225} = 85$ yds.

(4)...
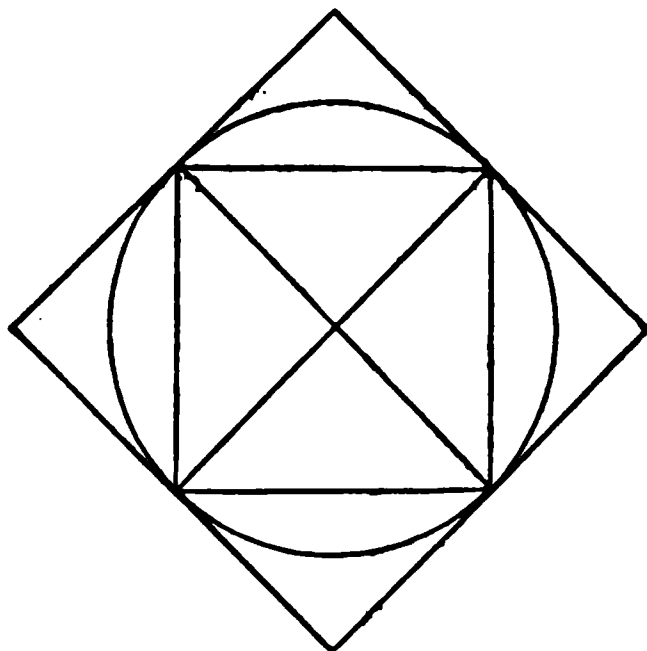
The area of the circumscribed square is double the area of the inscribed square.

$$
\begin{array}{c}
\text{sq. yds.} \quad\quad\quad \text{sq. yds.} \\
12\tfrac{1}{4} \times 2 = 24\tfrac{1}{2}
\end{array}
$$

(5)...

$$
\begin{array}{ll}
\begin{array}{r}
800 \\
900 \\
1200 \\
\hline
2)2900 \\
\hline
1450
\end{array}
&
\begin{array}{l}
1450 - \ 800 = 650 \\
1450 - \ 900 = 550 \\
1450 - 1200 = 250
\end{array}
\end{array}
$$

$1450 \times 650 \times 550 \times 250 = 129593750000$

$\sqrt{129593750000} = 359991$ square links

$= 3$ ac. 2 ro. 15·98 per.

(6)... Area of floor $= 17\frac{1}{2}$ ft. $\times 13\frac{2}{3}$ ft. $= 239\frac{1}{6}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 2\frac{1}{4}$ ft. $= 6\frac{3}{4}$ sq. ft.

Carpeting required $= 239\frac{1}{6} \div 6\frac{3}{4} = 35\frac{35}{81}$ yds.

(7)... See Appendix, page 179.

Area of circle $= 25^2 \times \cdot07958$

$= 625 \times \cdot07958$

$= 49\cdot7375$ sq. ft.

(8)...

ft.	in.
5	3
2	8
10	6
3	6
14	0
1	10
14	0
11	8
25	8	$= 25$ cu. ft. 1152 cu. in.

(9)... See figure in *Exercise X.* (7)

Perp. of triangle $= \sqrt{(13\frac{1}{2})^2 - (4\frac{1}{2})^2}$

$= \sqrt{182\cdot25 - 20\cdot25}$

$= \sqrt{162}$

$= 12\cdot7279$ ft.

Area of triangle $= 12\cdot7279$ ft. $\times 4\cdot5$ ft.

$= 57\cdot27555$ sq. ft.

(10)... $\frac{3}{8}$ mile $= 660$ yds.

8 ft. 3 in. $\times 2 = 16\frac{1}{2}$ ft. $= 5\frac{1}{2}$ yds.

660 yds. $\times 5\frac{1}{2}$ yds. $= 3630$ sq. yds.

3630 sq. yds. at 3s. 3d. per yd. $= £589$ 17s. 6d.

EXERCISE XVI.

$$\begin{array}{r} \text{ch.} \\ \text{10 ch. 45 li.} = 10\cdot45 \\ \text{3 ch. 75 li.} + \text{4 ch. 25 li.} = 8 \\ \hline 2)\overline{83\cdot60} \\ \hline 10)\overline{41\cdot80} \text{ sq. chains} \\ \hline 4\cdot18 \text{ ac.} \\ 4 \\ \hline \cdot72 \text{ ro.} \\ 40 \\ \hline 28\cdot8 \text{ po.} \end{array}$$

(1)...

Area of field = 4 ac. 28·8 po.

(2)...   39 sq. yds. $3\frac{3}{4}$ sq. ft. = $354\frac{3}{4}$ sq. ft.

Length of shorter side = $354\frac{3}{4}$ sq. ft. $\div 21\frac{1}{2}$ ft. = $16\frac{1}{2}$ ft.

(3)...$5\frac{1}{4}$ ft. $\times 2\frac{1}{3}$ ft. = $12\frac{1}{4}$ sq. ft. $6\frac{1}{3}$ ft. $\times 2\frac{3}{4}$ ft. = $17\frac{5}{12}$ sq. ft.

$$\begin{array}{cccccc} \text{sq. ft.} & & \text{sq. ft.} & & s. \quad d. & d. \\ 12\frac{1}{4} & ; & 17\frac{5}{12} & :: & 12 \ 3 = 147 & : \quad x \end{array}$$

$$x = \frac{\cancel{4}}{\cancel{49}} \times \frac{209}{\cancel{12}} \times \frac{\cancel{147}^{\ 3}}{1} = 209d. = 17s. \ 5d.$$

(4)... $\text{ES}^2 = \text{OE}^2 + \text{OS}^2$
$= (112\cdot5)^2 + (150)^2$
$= 12656\cdot25 + 22500$
$= 35156\cdot25$

$\text{ES} = 187\cdot5 = 187\frac{1}{2}$ miles
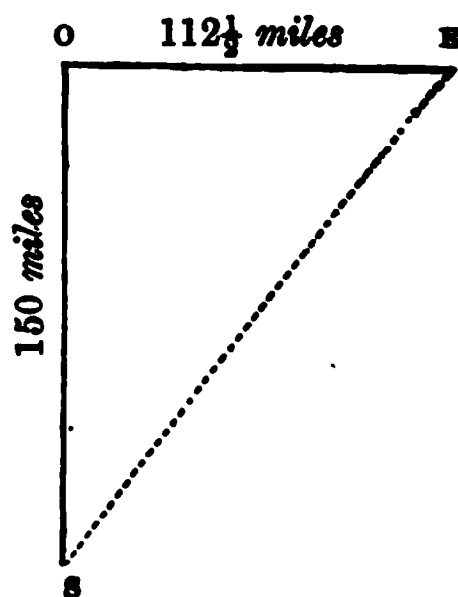
(5)...   Area of room $= 25\frac{1}{2}$ ft. $\times 18\frac{2}{3}$ ft. $= 476$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 2\frac{1}{3}$ ft. $= 7$ sq. ft.

Carpeting required $= 476 \div 7 = 68$ yds.

68 yds. at 4s. 9d. per yd. $= £16$ 3s.

(6)...Contents of each plank $= 13\frac{1}{2}$ ft. $\times 10\frac{1}{2}$ in. $= 11\frac{13}{16}$ sq. ft.

Area of platform $= 54$ yds. $\times 21$ yds. $= 1134$ sq. yds.

$= 10206$ sq. ft.

No. of planks required $= 10206 \div 11\frac{13}{16} = 864$

Cost, 10206 sq. ft. at $5\frac{1}{2}d.$ per ft. $= £233$ 17s. 9d.

(7)...   Diameter of pond $= 250$ yds. $\div 3\cdot1416$

$= 79\cdot577$ yds.

(8)... $10\frac{1}{2}$ ft. $\times 9$ ft. $\times 3\frac{1}{3}$ ft. $= 315$ cu. ft.

$= 11$ cu. yds. 18 cu. ft.

(9)... Area of field $= 2$ ac. 3 ro. 1 per. $= 441$ perches

Length of side $= \sqrt{441} = 21$ perches $= 115\frac{1}{2}$ yds.

(10)...   Area of two sides, $6\frac{1}{3}$ ft. $\times 2\frac{2}{3}$ ft. $\times 2 = 33\frac{7}{9}$ sq. ft.

Area of two ends, $3\frac{1}{4}$ ft. $\times 2\frac{2}{3}$ ft. $\times 2 = 17\frac{1}{3}$

Area of bottom, $6\frac{1}{3}$ ft. $\times 3\frac{1}{4}$ ft. $= 20\frac{7}{12}$

$71\frac{25}{36}$ sq. ft.

$71\frac{25}{36} \times 6\frac{1}{2} = 466\frac{1}{72}$ lb. $= 4$ cwt. $18\frac{1}{72}$ lb.

EXERCISE XVII.

(1)...   Area of rectangle = 50 yds. × 30·96845 yds.

= 1548·4225 sq. yds.

Side of square = $\sqrt{1548·4225}$ = 39·35 yds.

(2)...   Area of room = $23\frac{2}{3}$ ft. × $19\frac{1}{2}$ ft. = $461\frac{1}{2}$ sq. ft.

Area of 1 yd. carpeting = $461\frac{1}{2}$ sq. ft. ÷ 71 = $6\frac{1}{2}$ sq. ft.

Width of carpeting = $6\frac{1}{2}$ sq. ft. ÷ 3 ft. = $2\frac{1}{6}$ ft. = 2 ft. 2 in.

(3)...

ft.	′	″		
·17	8	4		
13	9	7		
230	0	4		
13	3	3	0	
	10	3	10	4
2)244	1	10	10	4

Area of triangle = 122ft. 0′ 11″ 5‴ 2⁗

(4)... $121\frac{1}{2}$ miles = 641520 ft.

641520 ft. × $30\frac{1}{4}$ ft. = 19405980 sq. ft. = $445\frac{1}{2}$ acres

$445\frac{1}{2}$ acres at £72 per acre = £32076

(5)...

	ft.	in.
	22	10
	17	8
	40	6
		2
Perimeter of room =	81	0
Height of room... =	10	4
	810	0
	27	0
9)837		0
Area of walls =	93	0 sq. yds.

(6)...   6 ft. 4 in. × 2 ft. 6 in. × 2 in. = $2\frac{23}{36}$ cu. ft.

$2\frac{23}{36}$ cu. ft. at 16s. 6d. per cu. ft. = £2 3s. $6\frac{1}{2}d$.

(7)...   Area of bottom = $7\frac{1}{2}$ ft. × $3\frac{1}{6}$ ft. = $23\frac{3}{4}$ sq. ft.

Required depth, 76 cu. ft. ÷ $23\frac{3}{4}$ sq. ft. = $3\frac{1}{5}$ ft.

(8)...
```
ft.    ft.    ft.
42 + 52  =  94
           38¼
          ─────
           752
          282
            23½
       ─────────
       2)3595½
       9)1797¾ sq. ft.
         199¾ sq. yds.
```
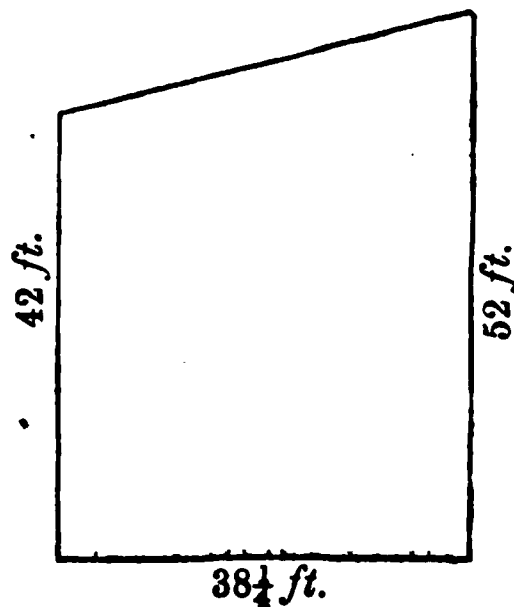

(9)...
```
ft.            ·7854
(45)² =      225 sq. yds.
           ─────
           39270
          15708
          15708
```
Area of pond = 176·7150 sq. yds.

(10)...
```
              12³    :    18³

   17 × 17 × 17   :   18 × 18 × 18

   2 × 2 × 2   :   3 × 3 × 3

        8      :    27
```

EXERCISE XVIII.

(1)... $60\frac{57}{162}$ sq. yds. = $548\frac{3}{18}$ sq. ft.

Length of room, $548\frac{3}{18}$ sq. ft. ÷ $19\frac{5}{8}$ ft. = $27\frac{2}{3}$ ft. = 27 ft. 8 in.

(2)...

$$\begin{array}{r} 1250 \\ 1400 \\ 1650 \\ \hline 2)\overline{4300} \\ \hline 2150 \end{array}$$

$2150 - 1250 = 900$

$2150 - 1400 = 750$

$2150 - 1650 = 500$

$$2150 \times 900 \times 750 \times 500 = 725625000000$$

$$\sqrt{725625000000} = 851836 \text{ sq. links} = 8 \text{ ac. } 2 \text{ ro. } 2 \cdot 9 \text{ po.}$$

(3)...　Area of room $= 35 \text{ ft.} \times 24\frac{3}{4} \text{ ft.} = 866\frac{1}{4}$ sq. ft.

Area of 1 yd. carpeting $= 3 \text{ ft.} \times 2\frac{1}{4} \text{ ft.} = 6\frac{3}{4}$ sq. ft.

Carpeting required $= 866\frac{1}{4} \div 6\frac{3}{4} = 128\frac{1}{3}$ yds.

$128\frac{1}{3}$ yds. at 3s. 9d. per yd. $= £24$ 1s. 3d.

(4)...51 sq. ft. 6 sq. in. $= 7350$ sq. in.　　11 ft. 8 in. $= 140$ in.

Base of triangle $= (7350 \div 140) \times 2 = 105$ in.

$$\text{Hypotenuse} = \sqrt{140^2 + 105^2}$$

$$= \sqrt{19600 + 11025}$$

$$= \sqrt{30625}$$

$$= 175 \text{ in.} = 14 \text{ ft. } 7 \text{ in.}$$

(5)...

	ft.	in.
	13	6
	3	2
	40	6
	2	3
Surface of each pillar	42	9
		12
9)	513	0
Surface of 12 pillars	57	0 sq. yds.

57 sq. yds. at $6\frac{1}{2}d.$ per sq. yd. $= £1$ 10s. $10\frac{1}{2}d.$

$$
\begin{array}{r}
\text{ft.} \qquad \text{sq. ft.} \\
(7\cdot5)^2 = 56\cdot25 \\
\cdot 7854 \\
\hline
22500 \\
28125 \\
45000 \\
39375 \\
\hline
\end{array}
$$

(6)...

Area of circle $= \overline{44\cdot178750}$ sq. ft.

(7)... 18 cu. ft. 1664 cu. in. $=$ 32768 cu. in.

Edge of cube $= \sqrt[3]{32768} = 32$ in. $= 2$ ft. 8 in.

$$
\begin{array}{rrr}
\text{ft.} & \text{in.} & \\
2 & 8 & \\
2 & 8 & \\
\hline
5 & 4 & \\
1 & 9 & 4 \\
\hline
7 & 1 & 4 \\
 & & 6 \\
\hline
\end{array}
$$

Surface of cube $= \overline{42\ \ 8\ \ 0} = 42$ sq. ft. 96 sq. in.

(8)... Diagonal path $= \sqrt{(213^2 + (159\cdot75)^2}$

$= \sqrt{45369 + 25520\cdot0625}$

$= \sqrt{70889\cdot0625}$

$= 266\cdot25 = 266\frac{1}{4}$ yds.

(9)... $2\frac{1}{2}$ acres $=$ 12100 sq. yds.

Perimeter of field $= \sqrt{12100} \times 4 = 110$ yds. $\times 4 = 440$ yds.

No. of hurdles required, $440 \div 2\frac{1}{2} = 176$

176 hurdles at 17s. 6d. per dozen $= £12$ 16s. 8d.

(10)...   See figure in *Exercise XII.* (6)

$$\text{Perp. of triangle} = \sqrt{(13\cdot5)^2 - (6\cdot75)^2}$$

$$= \sqrt{182\cdot25 - 45\cdot5625}$$

$$= \sqrt{136\cdot6875}$$

$$= 11\cdot69134 \text{ ft.}$$

$$\text{Area of triangle} = 11\cdot69134 \text{ ft.} \times 6\cdot75 \text{ ft.}$$

$$= 78\cdot9165 \text{ sq. ft.}$$

EXERCISE XIX.

1)...   Area of floor, $79\frac{1}{6}$ yds. $= 712\frac{1}{2}$ sq. ft.

ength of room, $712\frac{1}{2}$ sq. ft. $\div 22\frac{1}{2}$ ft. $= 31\frac{2}{3}$ ft. $= 31$ ft. 8 in.

2)...Area of yard, $\overset{\text{yds.}}{56\frac{1}{4}} \times \overset{\text{yds.}}{47\frac{1}{2}} = \overset{\text{in.}}{2025} \times \overset{\text{in.}}{1710} = \overset{\text{sq. in.}}{3462750}$

No. of stones required $= 3462750 \div 225 = 15390$

(3)... $12\frac{1}{2}$ chains $= 12\cdot5$ chains

$$
\begin{array}{r}
12\cdot5 \\
\hline
625 \\
250 \\
125 \\
\hline
10)\overline{156\cdot25} \text{ sq. chains} \\
\hline
15\cdot625 \text{ ac.} \\
4 \\
\hline
2\cdot500 \text{ ro.} \\
40 \\
\hline
20\cdot000 \text{ po.} \quad\quad 15 \text{ ac. } 2 \text{ ro. } 20 \text{ po.}
\end{array}
$$

(4)... Area of walls $= \overset{\text{ft.}}{(24} + \overset{\text{ft.}}{19)} \times 2 \times 10 = 860$ sq. ft.

Area of ceiling $= 24$ ft. $\times 19$ ft. $= 456$ sq. ft.

$$\overset{\text{sq. ft.}}{860} + \overset{\text{sq. ft.}}{456} = \overset{\text{sq. ft.}}{1316} = 146\frac{2}{9} \text{ sq. yds.}$$

(5)... Perimeter of ground, $\overset{\text{yds.}}{(123} + \overset{\text{yds.}}{82)} \times 2 = 410$ yards

Length of each hurdle $= \overset{\text{yds.}}{410} \div 180 = \overset{\text{yds.}}{2\frac{5}{18}} = 6$ ft. 10 in.

(6)... Contents of stack $= \overset{\text{yds.}}{25} \times \overset{\text{yds.}}{16\frac{1}{2}} \times \overset{\text{ft.}}{17\frac{1}{2}} = \overset{\text{cu. in.}}{112266000}$

Contents of each brick $= 9$ in. $\times 4\frac{1}{2}$ in. $\times 3$ in. $= 121\frac{1}{2}$ cu. in.

No. of bricks $= 112266000 \div 121\frac{1}{2} = 924000$

(7)...Contents of each plank, $13\frac{1}{2}$ ft. $\times 1\frac{1}{8}$ ft. $\times \frac{1}{8}$ ft. $= 1\frac{31}{32}$ cu. ft.

34 lb. 6 oz. $= 34\frac{3}{8}$ lb.

$$\overset{\text{cu. ft.}}{1} \quad : \quad \overset{\text{cu. ft.}}{1\frac{31}{32}} \times 36 \quad :: \quad \overset{\text{lb.}}{34\frac{3}{8}} \quad : \quad x$$

$$x = \frac{63}{\cancel{32}_{8}} \times \frac{\cancel{36}^{9}}{1} \times \frac{275}{8} = \frac{155925}{64}\text{lb.} = 1 \text{ ton } 1 \text{ cwt. } 3 \text{ qrs. } 0 \text{ lb. } 5\frac{1}{4}\text{oz.}$$

(8)...   Diameter $= \overset{\text{yds.}}{325} \div 3\cdot1416 = 103\cdot4504$ yards

(9)...   15 chains, 65 links $= 15\cdot65$ chains
          8 „   42 „ $= \underline{8\cdot42}$ „
                              3130
                             6260
                           12520
                    2)131·7730
                   10) 65·8865 sq. chains
                        6·58865 ac.
                              4
                    2·35460 ro.
                         40
                   14·18400   6 ac. 2 ro. 14·184 po.

E E

(10)... $7\frac{3}{4}$ ft. $\times 4\frac{1}{3}$ ft. $\times 3\frac{1}{2}$ ft. $= 117\frac{13}{24}$ cu. ft.

$$= 117 \text{ cu. ft. } 936 \text{ cu. in.}$$

EXERCISE XX.

(1)...The *complement* of an angle is its deficiency from a right angle.

$$
\begin{array}{lll}
90° & 0' & 0'' \\
67° & 25' & 45''
\end{array}
\qquad
\begin{array}{lll}
90° & 0' & 0'' \\
25° & 18' & 34\cdot45''
\end{array}
$$

Comp. $= \overline{22° \ 34' \ 15''}$ Comp. $= \overline{64° \ 41' \ 25\cdot55''}$

(2)...The *supplement* of an angle is its deficiency from two right angles.

$$
\begin{array}{lll}
180° & 0' & 0'' \\
53° & 15' & 45''
\end{array}
\qquad
\begin{array}{lll}
180° & 0' & 0'' \\
125° & 25' & 36''
\end{array}
$$

Supp. $= \overline{126° \ 44' \ 15''}$ Supp. $= \overline{54° \ 34' \ 24''}$

(3)... $1\frac{1}{4}$ mile $= 2200$ yds.   7 furlongs $= 1540$ yds.

2200 yds. $\times 1540$ yds. $= 338800$ sq. yds. $= 700$ acres

(4)... Perimeter of rectangular field $= \overset{\text{yds.}}{(625} + \overset{\text{yds.}}{289)} \times 2 = \overset{\text{yds.}}{1828}$

Side of square field $= \sqrt{625 \times 289}$

$$= \sqrt{180625}$$

$$= 425 \text{ yards}$$

Perimeter of field $= 1700$,,

$\therefore$ the perimeter of the rectangular field is 128 yards more than that of the square field.

(5)... Top and bottom of box $= 5\frac{1}{3} \times 3\frac{1}{2} \times 2 = 37\frac{1}{3}$ (ft. × ft. = sq. ft.)
Two sides $= 5\frac{1}{3} \times 2\frac{1}{2} \times 2 = 26\frac{2}{3}$
Two ends $= 3\frac{1}{2} \times 2\frac{1}{2} \times 2 = 17\frac{1}{2}$
Quantity of board required $= 81\frac{1}{2}$ sq. ft.

(6) ... Area of field $= (420)^2 \div 2$ (yds.)

$= 88200$ sq. yds.

$= 18$ ac. 35 po. $21\frac{1}{4}$ sq. yds.

(7)... By Duodecimals :—

ft.	in.	
22	6	
1	3	
22	6	
5	7	6
28	1	6
	9	
21	1	1 6 = 21 cu. ft. 162 cu. in.

By Vulgar Fractions :—

$22\frac{1}{2} \times 1\frac{1}{4} \times \frac{3}{4} = \frac{45}{2} \times \frac{5}{4} \times \frac{3}{4} = \frac{675}{32} = 21\frac{3}{32}$ cu. ft.

(ft. × ft. × ft. = cu. ft.)

By Decimal Fractions :—

22 ft. 6 in. $= 22\cdot5$ ft.
1 ft. 3 in. $= 1\cdot25$ ft.
$\overline{1125}$
450
225
$\overline{28\cdot125}$
9 in. $= \quad \cdot75$ ft.
$\overline{140625}$
196875
$\overline{21\cdot09375}$ cu. ft.

$$(8)\ldots \quad \overset{\text{ft.}}{(150)^2} = \overset{\text{yds.}}{(50)^2} = \begin{array}{r} \cdot7854 \\ 2500 \\ \hline 3927000 \\ 15708 \\ \hline 1963\cdot5000 \end{array} = 1963\tfrac{1}{2} \text{ sq. yds.}$$
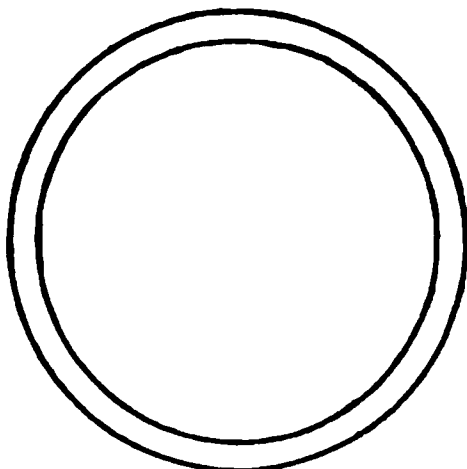
$(9)\ldots$

$$\text{Area of ring} = \overset{\text{ft.}}{(45} + \overset{\text{ft.}}{40)} \times \overset{\text{ft.}}{(45} - \overset{\text{ft.}}{40)} \times \cdot7854$$

$$= 85 \text{ ft.} \times 5 \text{ ft.} \times \cdot7854$$

$$= 425 \text{ sq. ft.} \times \cdot7854$$

$$= 333\cdot795 \text{ sq. ft.}$$

$$(10)\ldots\overset{\text{yds.}\ \text{ft.}\ \ \text{in.}}{250 \times 8 \times \underset{\underset{27}{2}}{13\tfrac{1}{2}}} \ : \ \overset{\text{yds.}\ \text{ft.}\ \ \text{in.}}{880 \times 9 \times \underset{\underset{36}{2}}{18}} \ :: \ \overset{\text{bricks}}{96000} \ : \ x$$

$$x = \frac{\overset{110}{\cancel{880}} \times 9 \times \overset{12}{\cancel{36}} \times \overset{384}{\cancel{96000}}}{\underset{\underset{3}{\cancel{750}}}{\cancel{750}} \times \cancel{8} \times \cancel{27}} = 506880 \text{ bricks}$$

EXERCISE XXI.

(1)...

$$cd = 15 - (10\tfrac{1}{2} \times 2) = 15 - 1\tfrac{3}{4} = 13\tfrac{1}{4}$$
(ft.) (in.) (ft.) (ft.) (ft.)

2 shelves, each $18\tfrac{1}{2}$ long = 37 (ft.)
2   „   „ $13\tfrac{1}{4}$ long = $26\tfrac{1}{2}$ (ft.)
Length of board required = $63\tfrac{1}{2}$ ft.

$63\tfrac{1}{2}$ ft. $\times \tfrac{7}{8}$ ft. = $55\tfrac{9}{16}$ sq. ft.
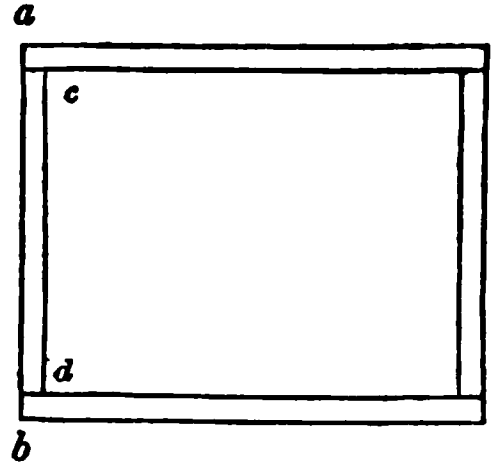
$55\tfrac{9}{16}$ sq. ft. at 8d. per sq. ft. = £1 17s. 0½d.

(2)...

$$(7)^2 + (8\tfrac{1}{2})^2 + (9)^2 = 49 + 72\tfrac{1}{4} + 81 = 202\tfrac{1}{4}$$

Side of required square = $\sqrt{202\cdot25}$

= 14·2214 ft.

(3)... Area of floor = $18\tfrac{3}{4}$ ft. $\times$ 15 ft. = $281\tfrac{1}{4}$ sq. ft.

Area of 1 yd. carpeting = 3 ft. $\times 1\tfrac{7}{8}$ ft. = $5\tfrac{5}{8}$ sq. ft.

Carpeting required = $281\tfrac{1}{4} \div 5\tfrac{5}{8}$ = 50 yds.

50 yds. at 5s. 3d. per yd. = £13 2s. 6d.

(4)... Length of ground = $7\tfrac{1}{4}$ ft. $\times 42$ = $304\tfrac{1}{2}$ ft.

Breadth of   „   = $7\tfrac{1}{4}$ ft. $\times 26$ = $188\tfrac{1}{2}$ ft.

Area = $304\tfrac{1}{2}$ ft. $\times 188\tfrac{1}{2}$ ft. = $57398\tfrac{1}{4}$ sq. ft.

= 1 acre 1 rood 10 per. 25 sq. yds. 108 sq. in.

(5)...See Euclid, Book I. Prop. xxxii. Cor. 1.

$$\text{6 angles of hexagon} + 4 \text{ rt. angles} = 12 \text{ rt. angles}$$

$$\text{6 angles of hexagon} = 8 \text{ rt. angles}$$

$$\text{each angle of hexagon} = \tfrac{4}{3} \text{ of a rt. angle}$$

$$= \tfrac{4}{3} \text{ of } 90°$$

$$= 120°$$

(6)...

$$1 \text{ acre} = 4840 \text{ sq. yds.}$$

$$\text{Diameter of pool} = \sqrt{4840 \div \cdot 7854}$$

$$= \sqrt{6162 \cdot 46498599}$$

$$= 78 \cdot 5013 \text{ yds.}$$

(7)...

$$17\tfrac{1}{2} \text{ miles} \times 12 \text{ yds.} \times 5\tfrac{1}{2} \text{ ft.} = 677600 \text{ cu. yds}$$

$$677600 \text{ cu. yds. at } 4\tfrac{1}{2}d. \text{ per cu. yd.} = £12705$$

(8)...

$$\text{Area of ellipse} = 25 \text{ ft.} \times 18 \text{ ft.} \times \cdot 7854$$

$$= 450 \text{ sq. ft.} \times \cdot 7854$$

$$= 353 \cdot 43 \text{ sq. ft.}$$

(9)...

$$\text{Horizontal section of column} = (16)^2 \overset{\text{in.}}{} \times \cdot 7854$$

$$= 256 \text{ sq. in.} \times \cdot 7854$$

$$= 201 \cdot 0624 \text{ sq. in.}$$

$$\text{Solidity of column} = 201 \cdot 0624 \text{ sq. in.} \times 164 \text{ in.}$$

$$= 32974 \cdot 2336 \text{ cu. in.}$$

$$= 19 \cdot 0823 \text{ cu. ft.}$$

	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.

$$(10)\ldots\ 7\quad 8 + 7\quad 8 + 6\quad 10 + 5\quad 9 = 27\quad 11$$

$$\begin{array}{rr} 3 & 6 \\ \hline 83 & 9 \\ 13\ 11 & 6 \\ \hline 97\quad 8 & 6 \\ & 3 \\ \hline 293\quad 1\quad 6 \end{array} = 293\tfrac{1}{8}\ \text{sq. ft.}$$

$293\tfrac{1}{8}$ sq. ft. at 1s. 9d. per ft. = £17 1s. $11\tfrac{3}{4}d$.

EXERCISE XXII.

		ft.	in.

$$(1)\ldots\qquad 43\tfrac{3}{4}\ \text{yds.} = 131\quad 3$$
$$23\ \text{ft. 6 in.} + 20\ \text{ft. 10 in.} = \underline{44\quad 4}$$
$$\begin{array}{rr} 5775 & 0 \\ 43 & 9 \\ \hline 2)\overline{5818} & 9 \\ \hline 9)\overline{2909}\quad 4 & 6 \\ \hline \end{array}$$
$$323\ \text{sq. yds. 2 sq. ft. 54 sq. in.}$$

(2)...

ft.	in.	ft.	in.	sq. ft.	sq. in.
5	3 × 4	5	=	23	27
4	6 × 3	8	=	16	72
Area of frame =				6	99

5 ft. 3 in.

4 ft. 6 in.

4 ft. 5 in.

3 ft. 8 in.

(3)... Area of window = $7\tfrac{1}{2}$ ft. × $4\tfrac{1}{2}$ ft. = 90 in. × 54 in.
= 4860 sq. in.

Area of each quarry = $\tfrac{1}{2}(6 \times 4\tfrac{1}{2}) = 13\tfrac{1}{2}$ sq. in.

No. of quarries required, $4860 \div 13\tfrac{1}{2} = 360$

$$\text{(4)...} \quad \text{Area of circle} = (8\cdot5)^2 = 72\cdot25 \text{ sq. ft.}$$

$$\text{Radius of circle} = \sqrt{72\cdot25 \div 3\cdot1416}$$

$$= \sqrt{22\cdot99783549}$$

$$= 4\cdot7956 \text{ ft.}$$

(5)...   Area of floor, $27\frac{1}{2}$ ft. $\times 21$ ft. $= 577\frac{1}{2}$ sq. ft.

Area of 1 yd. matting, 3 ft. $\times 2\frac{5}{8}$ ft. $= 7\frac{7}{8}$ sq. ft.

Matting required, $577\frac{1}{2} \div 7\frac{7}{8} = 73\frac{1}{3}$ yds.

$73\frac{1}{3}$ yds. at 1s. 3d. per yd. $= £4$ 11s. 8d.

(6)...

ft.	in.	
6	3	
2	9	
12	6	
4	8	3
17	2	3
1	8	
17	2	3
11	5	6
28	7	9

$28 \quad 7 \quad 9 = 28$ cu. ft. 1116 cu. in.

(7)...
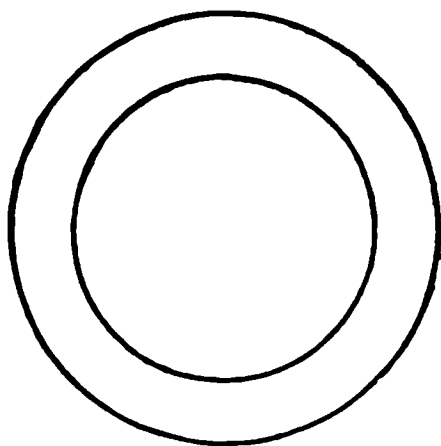
Area of walk $= (26+18) \times (26-18) \times \cdot7854$

$$= 44 \text{ ft.} \times 8 \text{ ft.} \times \cdot7854$$

$$= 276\cdot4608 \text{ sq. ft.}$$

(8)...   Area of field $= 48400$ sq. yds.

Side of field $= \sqrt{48400}$

$= 220$ yds.

Perimeter of field $= 220$ yds. $\times 4 = 880$ yds.

880 yds. at 2s. 9d. per yd. $= £121$

$$
\begin{array}{ccccccc}
\text{sq. yds.} & & \text{yds.} & \text{yds.} & & s. & d. \\
(9)\ldots\quad 4840 & : & 220 \times 135 & :: & 13 & 9 & : & x \\
& & & & & 12 & \\
& & & & & \overline{165} &
\end{array}
$$

$$x = \frac{\cancel{220} \times 135 \times \cancel{165}^{15}}{\cancel{4840}} = 1012\tfrac{1}{2}d. = £4 \ 4s. \ 4\tfrac{1}{2}d.$$

(10)...

Area of table$=5$ ft. 6 in. $\times 21$ in.$=66$ in. $\times 21$ in.$=1386$ sq. in.

Area of each circular hole$=(10\tfrac{1}{2})^{2}\ \overset{\text{in.}}{}\times \cdot 7854 = 86 \cdot 59035$ sq. in.

Remainder, $1386 - (86 \cdot 59035 \times 2) = 1212 \cdot 8193$ sq. in.
$= 8 \cdot 42235625$ sq. ft.

EXERCISE XXIII.

(1)...   Side of square $= \sqrt{80 \times 45}$

$= \sqrt{3600}$

$= 60$ ft.

(2)...   22 ft. 8 in. $=$ 272 in.   17 ft. $=$ 204 in.

$$\text{Hypotenuse of triangle} = \sqrt{272^2 + 204^2}$$
$$= \sqrt{73984 + 41616}$$
$$= \sqrt{115600}$$
$$= 340 \text{ in.} = 28 \text{ ft. 4 in.}$$

(3)...   36 ft. 6 in. $=$ 438 in.   27 ft. 6 in. $=$ 330 in.

$$\text{Base of triangle} = \sqrt{438^2 - 330^2}$$
$$= \sqrt{191844 - 108900}$$
$$= \sqrt{82944}$$
$$= 288 \text{ in.} = 24 \text{ ft.}$$

(4)...Perpendicular of triangle $= \sqrt{(67 \cdot 85)^2 - (40 \cdot 71)^2}$
$$= \sqrt{4603 \cdot 6225 - 1657 \cdot 3041}$$
$$= \sqrt{2946 \cdot 3184}$$
$$= 54 \cdot 28 \text{ ft.}$$

(5)...Perpendicular of triangle $= \sqrt{(4 \cdot 25)^2 - (2 \cdot 55)^2}$
$$= \sqrt{18 \cdot 0625 - 6 \cdot 5025}$$
$$= \sqrt{11 \cdot 56}$$
$$= 3 \cdot 4 \text{ chains}$$
$$\text{Area of triangle} = \tfrac{1}{2}(3 \cdot 4 \times 2 \cdot 55)$$
$$= \tfrac{1}{2}(8 \cdot 67)$$
$$= 4 \cdot 335 \text{ sq. chains}$$
$$= 1 \text{ rood } 29 \cdot 36 \text{ poles}$$

(6)...

$$\begin{array}{r} 50 \\ 72 \\ 88 \\ \hline 2)\overline{210} \\ \hline 105 \end{array}$$

$$105-50 = 55$$
$$105-72 = 33$$
$$105-88 = 17$$

$$105 \times 55 \times 33 \times 17 = 3239775$$

Area of triangle $= \sqrt{3239775} = 1799 \cdot 937498$ sq. ft.

Side of square $= \sqrt{1799 \cdot 937498}$

$$= 42 \cdot 425 \text{ ft.}$$

(7)...

$$\begin{array}{r} 2)\overline{126} \\ \hline 63 \end{array}$$

$$63-42 = 21$$

$$63 \times 21 \times 21 \times 21 = 583443$$

Area of triangle $= \sqrt{583443} = 763 \cdot 8344$ sq. ft.

(8)...

Area of ellipse $= 18 \cdot 5$ ft. $\times 12 \cdot 5$ ft. $\times \cdot 7854$

$$= 177 \cdot 991275 \text{ sq. ft.}$$

(9)...

Area of quadrant $= \frac{1}{4} \{(10 \cdot 5)^2 \times 3 \cdot 1416\}$

$$= \frac{1}{4}(346 \cdot 3614)$$

$$= 86 \cdot 59035 \text{ sq. ft.}$$

$$= 86 \text{ sq. ft. } 85 \text{ sq. in.}$$

(10)...Area of mouth of shaft, $5^2 \times \cdot 7854 = 19 \cdot 635$ sq. ft.

$19 \cdot 635$ sq. ft. $\times 180$ ft. $= 3534 \cdot 3$ cu. ft.

EXERCISE XXIV.

(1)... Area of walls = 23 yds. 2 ft. 6 in. × 9 ft. 9 in.

$$= 71\tfrac{1}{2} \text{ ft.} \times 9\tfrac{3}{4} \text{ ft.}$$

$$= 697\tfrac{1}{8} \text{ sq. ft.}$$

Area of 1 yd. paper = 3 ft. × 22 in. = 3 ft. × $1\tfrac{5}{6}$ ft. = $5\tfrac{1}{2}$ sq. ft.

Paper required, $697\tfrac{1}{8} \div 5\tfrac{1}{2} = 126\tfrac{3}{4}$ yds.

(2)... $7\tfrac{1}{2}$ acres = 36300 sq. yds.

Length of side of field = $\sqrt{36300}$ = 190·525 yds.

(3)...See Euclid, Book I. Prop. xxxii. Cor. 1.

7 angles of heptagon + 4 rt. angles = 14 rt. angles

7 angles of heptagon = 10 rt. angles

Each angle of heptagon = $\tfrac{10}{7}$ of a rt. angle

$$= \tfrac{10}{7} \text{ of } 90°$$

$$= 128\tfrac{4}{7}°$$

(4)...
$$\overset{\text{in.}}{33} \div \overset{\text{in.}}{2\tfrac{3}{4}} = 12 \text{, diameters in length of plate}$$

$$27\tfrac{1}{2} \div 2\tfrac{3}{4} = 10 \text{, diameters in breadth of plate}$$

No. of circular pieces = 12 × 10 = 120

(5)...6 ft. × $4\tfrac{1}{2}$ ft. × 3 ft. = 81 cu. ft. $(4\tfrac{1}{2}$ ft.$)^3 = 91\tfrac{1}{8}$ cu. ft.

$$\overset{\text{cu. ft.}}{81} \; : \; \overset{\text{cu. ft.}}{91\tfrac{1}{8}} \; :: \; \overset{\text{t. cwt.}}{5 \;\; 5} = \overset{\text{cwt.}}{105} \; : \; x$$

$$x = \frac{1}{\cancel{81}} \times \frac{\overset{9}{\cancel{729}}}{8} \times \frac{105}{1} = \frac{945}{8} \text{ cwt.} = 5 \text{ tons } 18 \text{ cwt. } 14 \text{ lb.}$$

(6)... Edge of cube $= \sqrt[3]{421\cdot875} = 7\cdot5$ ft.

Area of each side $= (7\cdot5)^2 = 56\cdot25 = 56\frac{1}{4}$ sq. ft.

(overset: ft.)

(7)...Area of circle $= (16)^2 \times 3\cdot1416 = 804\cdot2496$ sq. in.

(overset: in.)

$360° \quad : \quad 27° \quad :: \quad 804\cdot2496 \quad : \quad 60\cdot31872$, area of sector

(oversets: sq. in. ... sq. in.)

(8)...

124 ft.

108 ft.

100 ft.

84 ft.
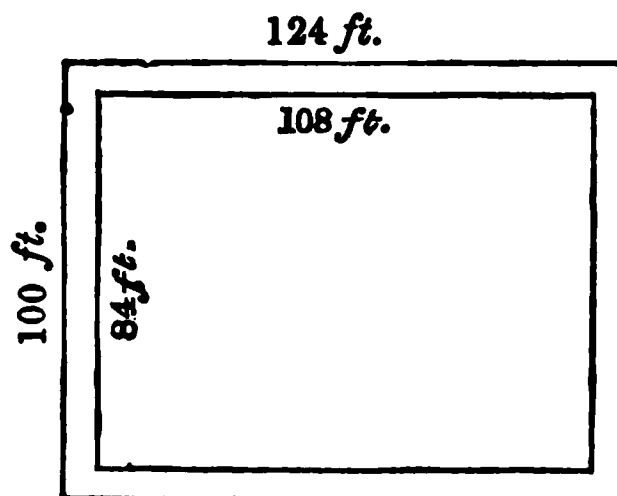
$$\begin{array}{c}
124 \times 100 = 12400 \\
108 \times 84 = 9072 \\
\hline
9)3328
\end{array}$$

(oversets: ft. ft. sq. ft.)

Area of walk $= 369$ sq. yds. 7 sq. ft.

(9)...Diameter of circle $= 11\frac{1}{2}$ inches

The diameter of the circle is equal to a side of the square.

Area of square $= 11\frac{1}{2} \times 11\frac{1}{2} = 132\frac{1}{4}$ sq. in.

(oversets: in. in.)
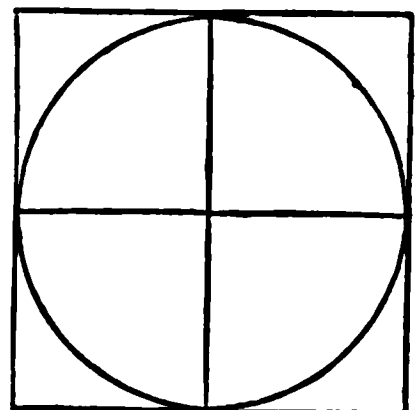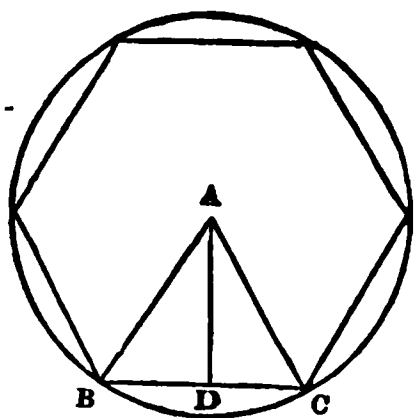
(10)...The hexagon consists of six equilateral triangles, the side of each measuring $4\frac{1}{2}$ feet

$$
\begin{aligned}
\text{Area of each triangle} &= \text{BD} \cdot \text{AD} \\
&= 2\cdot25 \times \sqrt{(4\cdot5)^2 - (2\cdot25)^2} \\
&= 2\cdot25 \times \sqrt{15\cdot1875} \\
&= 2\cdot25 \times 3\cdot8971 \\
&= 8\cdot768475 \text{ sq. ft.}
\end{aligned}
$$

$8\cdot768475 \times 6 = 52\cdot61085$ sq. ft., area of hexagon

EXERCISE XXV.

(1)...Length of wall $= (65$ yds. $+ 42$ yds.$) \times 2 = 214$ yds.

$$8 \text{ ft. } 9 \text{ in.} = 2\frac{11}{12} \text{ yds.}$$

Surface of wall $= 214$ yds. $\times 2\frac{11}{12}$ yds. $= 624\frac{1}{6}$ sq. yds.

(2)... 3 cu. yds. 4 cu. ft. 1224 cu. in. $= 148104$ cu. in.

3 ft. 8 in. $\times$ 2 ft. 10 in. $= 44$ in. $\times 34$ in. $= 1496$ sq. in.

148104 cu. in. $\div 1496$ sq. in. $= 99$ in. $= 8$ ft. 3 in., length of stone

(3)...

$$
\begin{array}{ccc}
\text{ft.} \quad \text{in.} & & \text{ft.} \quad \text{in.} \\
(2 \quad 8)^3 & : & (3 \quad 8)^3 \\
32^3 & : & 44^3 \\
\cancel{32} \times \cancel{32} \times \cancel{32} & : & \cancel{44} \times \cancel{44} \times \cancel{44} \\
8 \times 8 \times 8 & : & 11 \times 11 \times 11 \\
512 & : & 1331
\end{array}
$$

(4)...Perimeter of room $=$ (26 ft. 3 in. $+$ 18 ft. 9 in.) $\times 2 = 90$ ft.

Surface of walls $= 90$ ft. $\times 10\frac{1}{2}$ ft. $= 945$ sq. ft.

Length of paper used, 12 yds. $\times 14 = 168$ yds.' $= 504$ ft.

Width of paper, 945 sq. ft. $\div 504$ ft. $= 1\frac{7}{8}$ ft. $= 22\frac{1}{2}$ in.

(5)... Area of floor $= 79\frac{1}{8}$ yds. $\times$ 2 ft. $4\frac{1}{2}$ in. $= 237\frac{1}{2}$ ft. $\times 2\frac{3}{8}$ ft. $= 564\frac{1}{16}$ sq. ft.

$$= 564 \cdot 0625 \text{ sq. ft.}$$

Side of room $= \sqrt{564 \cdot 0625} = 23 \cdot 75$ ft. $= 23$ ft. 9 in.

(6)...

$$
\begin{array}{ll}
160 & 300 - 160 = 140 \\
190 & 300 - 190 = 110 \\
250 & 300 - 250 = 50 \\
2)\overline{600} & \\
\overline{300} &
\end{array}
$$

$$300 \times 140 \times 110 \times 50 = 231000000$$

Area $= \sqrt{231000000} = 15198$ sq. yds. $= 3$ acres 678 sq. yds.

$$
\begin{array}{cccc}
\text{sq. yds.} & \text{sq. yds.} & s. \quad d. & d. \\
4840 & : \quad 15198 & :: \quad 12 \quad 6 = 150 & : \quad x
\end{array}
$$

$$x = \frac{15198 \times 150}{4840} = 471\frac{3}{242}d. = £1 \; 19s. \; 3\frac{3}{242}d.$$

(7)... Area of table $= (4\frac{1}{4})^2 \times \cdot 7854 = 14 \cdot 1862875$ sq. ft.

(8)...Circumference of circle $= 6\frac{1}{4}$ ft. $\times 2 \times 3 \cdot 1416 = 39 \cdot 27$ ft.

$$
\begin{array}{cccc}
& & \text{ft.} & \text{ft.} \\
360° & : \quad 22° \; 30' & :: \quad 39 \cdot 27 & : \quad 2 \cdot 454375, \text{ length of arc.}
\end{array}
$$

(9)...
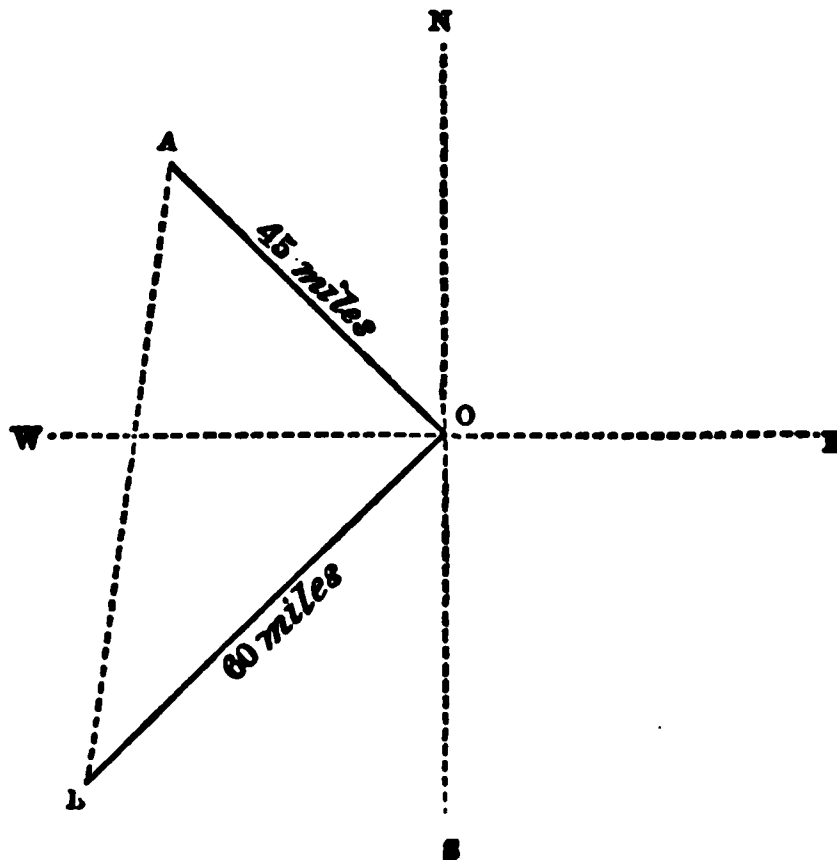
$$OA = 7\tfrac{1}{2} \text{ mi.} \times 6 = 45 \text{ miles}$$
$$OB = 10 \text{ mi.} \times 6 = 60 \text{ miles}$$

$$AB^2 = OA^2 + OB^2$$
$$= 45^2 + 60^2$$
$$= 2025 + 3600$$
$$= 5625$$
$$\therefore AB = 75 \text{ miles}$$

(10)... Let x feet $=$ a side of the square

Then $(x+3) =$ a side of the enlarged square

Now $(x+3)^2 - x^2 = 81$
$$x^2 + 6x + 9 - x^2 = 81$$
$$6x + 9 = 81$$
$$6x = 72$$
$$x = 12 \text{ feet, side of square}$$

EXERCISE XXVI.

(1)...Capacity of cistern $= 2\tfrac{7}{8}$ ft. $\times 4\tfrac{1}{3}$ ft. $\times 2\tfrac{2}{3}$ ft. $= 33\tfrac{2}{9}$ cu. ft.

Weight of water $= 62\tfrac{1}{2}$ lb. $\times 33\tfrac{2}{9} = 2076\tfrac{7}{18}$ lb.

(2)... $$85^2 \times 5 = 36125 \text{ sq. yds.}$$

$$\sqrt{36125} = 190.0657 \text{ yds.}$$

(3)... $$40 \text{ in.} \times 2\tfrac{1}{4} \text{ in.} \times 1\tfrac{1}{2} \text{ in.} = 135 \text{ cu. in.}$$

$$4\tfrac{2}{5} \text{ oz.} \times 135 = 594 \text{ oz.} = 37 \text{ lb. } 2 \text{ oz.}$$

(4)... $$\tfrac{5}{8} \text{ of a mile} = 1100 \text{ yds.}$$

$$\text{radius of circle} = 1100 \div 6.2832 = 175.07 \text{ yds.}$$

(5)... $$\text{Hypotenuse of triangle} = \sqrt{33^2 + 56^2}$$

$$= \sqrt{1089 + + 3136}$$

$$= \sqrt{4225}$$

$$= 65 \text{ yds.}$$

(6)...BD, the diameter of the circle

$$= \sqrt{AB^2 + AD^2}$$

$$= \sqrt{2 . AB^2}$$

$$= \sqrt{2 \times (19\tfrac{3}{4})^2}$$

$$= \sqrt{390.0625 \times 2}$$

$$= \sqrt{780.125}$$

$$= \sqrt{27.9307} \text{ ft.}$$
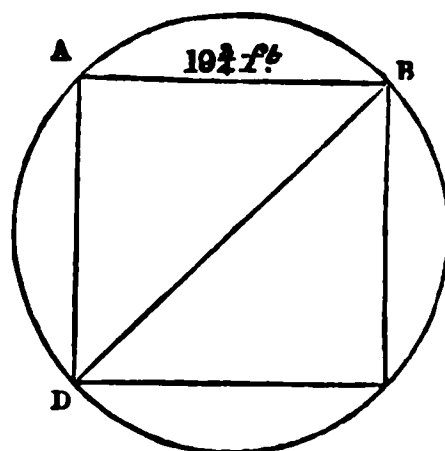
(7)...Contents of each step $= 7\tfrac{1}{2} \text{ ft.} \times 1\tfrac{1}{4} \text{ ft.} \times \tfrac{3}{4} \text{ ft.} = 6\tfrac{9}{16} \text{ cu. ft.}$

Contents of flight $= 6\tfrac{9}{16} \text{ cu. ft.} \times 14 = 91\tfrac{7}{8} \text{ cu. ft.}$

$$= 91 \text{ cu. ft. } 1512 \text{ cu. in.}$$

(8)... $$7\tfrac{1}{2} \text{ miles} = 39600 \text{ ft.}$$

$$\text{Circumference of wheel} = 39600 \text{ ft.} \div 2640 = 15 \text{ ft.}$$

$$\text{Diameter} = 15 \text{ ft.} \div 3.1416 = 4.7746 \text{ ft.}$$

F F

(9)...Perimeter of room $= (25\frac{1}{2}$ ft. $+17\frac{1}{4}$ ft.$) \times 2 = 85\frac{1}{2}$ ft.

Area of walls $= 85\frac{1}{2}$ ft. $\times 10\frac{2}{3}$ ft. $= 912$ sq. ft. $= 101\frac{1}{3}$ sq. yds.

Area of ceiling $= 25\frac{1}{2}$ ft. $\times 17\frac{1}{4}$ ft. $= 439\frac{7}{8}$ sq. ft. $= 48\frac{7}{8}$ sq. yds.

$$
\begin{array}{lccc}
 & \pounds & s. & d. \\
101\frac{1}{3} \text{ sq. yds. at } 10\frac{1}{2}d. \text{ per yd.} = & 4 & 8 & 8 \\
48\frac{7}{8} \text{ sq. yds. at } 16d. \text{ per yd.... } = & 3 & 5 & 2 \\
\hline
 & \pounds 7 & 13 & 10
\end{array}
$$

(10)...See Euclid, Book I. Prop. xxxii. Cor. 1.

8 angles of octagon $+4$ rt. angles $= 16$ rt. angles

8 angles of octagon $= 12$ rt. angles

Each angle of octagon $= \frac{3}{2}$ rt. angles

$= \frac{3}{2}$ of $90°$

$= 135°$

EXERCISE XXVII.

(1)...

$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
9 & 9 \\
4 & 2 \\
\hline
39 & 0 \\
1 & 7 \quad 6 \\
\hline
\end{array}
$$

Area of table $= 40 \quad 7 \quad 6 = 40\frac{5}{8}$ sq. ft.

Cost, $40\frac{5}{8}$ sq. ft. at $1s.$ $8d.$ per ft. $= \pounds 3$ $7s.$ $8\frac{1}{2}d.$

(2)...

$$
\begin{array}{r}
\text{ft.} \\
135 \\
47\cdot55+32\cdot85 = 80\cdot4 \\
\hline
540 \\
1080 \\
\hline
2)10854\cdot0 \\
\hline
9)\ 5427 \text{ sq. ft.} \\
\hline
\end{array}
$$

Area of trapezium $= \qquad 603$ sq. yds.

(3)... $\quad$ Base of triangle $= \sqrt{61^2 - 60^2}$

$$= \sqrt{3721 - 3600}$$

$$= \sqrt{121}$$

$$= 11 \text{ feet}$$

(4)...Length of rectangle $= 1691\frac{1}{4}$ sq. ft. $\div 33$ ft. $= 51\frac{1}{4}$ ft.

(5)... $\quad$ Top and bottom, $5\frac{1}{4}$ ft. $\times 3\frac{3}{4}$ ft. $\times 2 = 39\frac{3}{8}$ sq. ft.

$\quad$ Two sides, $\quad\quad 5\frac{1}{4}$ ft. $\times 3\frac{1}{4}$ ft. $\times 2 = 34\frac{1}{8}$ sq. ft.

$\quad$ Two ends, $\quad\quad 3\frac{3}{4}$ ft. $\times 3\frac{1}{4}$ ft. $\times 2 = 24\frac{3}{8}$ sq. ft.

$\quad\quad\quad\quad\quad$ Board required $= \overline{97\frac{7}{8}}$ sq. ft.

(6)...Contents of stack, 30 ft. $\times$ 18 ft. $\times$ 10 ft. $= 5400$ cu. ft.

$$= 9331200 \text{ cu. in.}$$

Contents of each brick, 9 in. $\times 4\frac{1}{2}$ in. $\times 3$ in. $= 121\frac{1}{2}$ cu. in.

No. of bricks, $9331200 \div 121\frac{1}{2} = 76800$

(7)... $\quad\quad$ 34 cu. ft. 567 cu. in. $= 59319$ cu. in.

Edge of cube $= \sqrt[3]{59319} = 39$ in. $= 3$ ft. 3 in.

$$
\begin{array}{cc}
\text{ft.} & \text{in.} \\
3 & 3 \\
3 & 3 \\
\hline
9 & 9 \\
& 9 \quad 9
\end{array}
$$

Area of each side, $\overline{10 \quad 6 \quad 9}$

$\quad\quad\quad\quad\quad\quad\quad\quad 6$

Area of 6 sides, $\overline{63 \quad 4 \quad 6} = 63$ sq. ft. 54 sq. in.
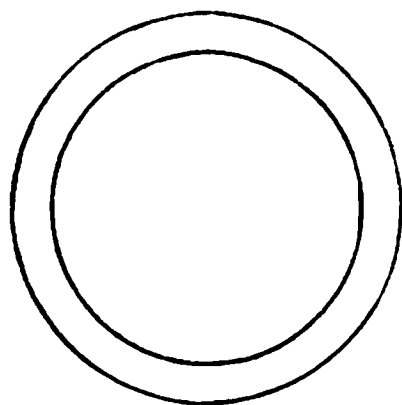
(8)...Area of outer circle $= 25^2 \times \cdot7854$·

Area of inner circle $= 20^2 \times \cdot7854$

Area of walk $= (25^2 - 20^2) \times \cdot7854$

$= 225 \times \cdot7854$

$= 176\cdot715$ sq. ft.

$= 19\cdot635$ sq. yds.

(9)...Diameter of tower *and* moat $= \overset{\text{yds.}}{28} + (\overset{\text{ft.}}{14} \times 2) = 112$ ft.

Area of moat $= (112 + 84) \times (112 - 84) \times \cdot7854$

$= 196 \times 28 \times \cdot7854$

$= 4310\cdot2752$ sq. ft.

$= 478\cdot9194$ sq. yds.

(10)... $9\frac{1}{3}$ ft. $\times 6\frac{1}{2} \times 2\frac{1}{4}$ ft. $= 136\frac{1}{2}$ cubic feet

EXERCISE XXVIII.

(1)... 3 angles of triangle $= 180°$

$$43\cdot44°$$
$$2)\overline{136\cdot56°}$$

Each equal angle contains $\overline{68\cdot28°} = 68° 16' 48''$

$$60$$
$$\overline{16\cdot80'}$$
$$60$$
$$\overline{48\cdot00''}$$

(2)...   5 angles of pentagon $= 6$ rt. angles $= 540°$

$$5 + 7 + 8 + 11 + 14 = 45$$

45	:	5	::	540°	:	60°
45	:	7	::	540°	:	84°
45	:	8	::	540°	:	96°
45	:	11	::	540°	:	132°
45	:	14	::	540°	:	168°

$$
\begin{array}{ccccccc}
& \text{ft.} & \text{in.} & \text{ft.} & \text{in.} & \text{ft.} & ' & '' \\
\textbf{(3)}\ldots & 5 & 9\tfrac{1}{2} + 4 & 10\tfrac{3}{4} & = & 10 & 8 & 3 \\
& & & & & 3 & 8 \\
\hline
& & & & & 32 & 0 & 9 \\
& & & & & 7 & 1 & 6 \\
\hline
& & & & 2)& 39 & 2 & 3 \\
\hline
& & & & & 19' & 7' & 1\tfrac{1}{2}'' = 19 \text{ sq. ft. } 85\tfrac{1}{2} \text{ sq. in}
\end{array}
$$

(4)...Area of field 38 ac. 2 ro. 38 po. $10\tfrac{1}{2}$ sq. yds.=187500 sq. yds.

Width of field = 187500 sq. yds.÷500 yds. = 375 yds.

Length of diagonal path = $\sqrt{500^2 + 375^2}$

$$= \sqrt{250000 + 140625}$$

$$= \sqrt{390625}$$

$$= 625 \text{ yds.}$$

(5)...Area of platform $43\tfrac{1}{2}$ yds. × 14 yds. = 609 sq. yds.
= 5481 sq. ft.

Area of each plank = $14\tfrac{1}{2}$ ft. × $\tfrac{7}{8}$ ft. = $12\tfrac{11}{16}$ sq. ft

No. of planks required, $5481 \div 12\tfrac{11}{16}$ = 432

Cost, 5481 sq. ft. at $8\tfrac{1}{2}d.$ per ft. = £194 2s. $4\tfrac{1}{2}d.$

(6)... $22\tfrac{1}{2}$ ft. × $19\tfrac{1}{2}$ ft. = $438\tfrac{3}{4}$ sq. ft. = $48\tfrac{3}{4}$ sq. yds.

$48\tfrac{3}{4}$ sq. yds. −30 sq. yds. = $18\tfrac{3}{4}$ sq. yds.

$18\tfrac{3}{4}$ sq. yds. of matting at 15d. per yd. = £1 3s. $5\tfrac{1}{4}d.$

(7)... £93 10s.÷4s. 6d. = $415\tfrac{5}{9}$ sq. yds. = 3740 sq. ft.

$$
\begin{array}{ccc}
& \text{sq. ft.} \quad \text{ft.} & \text{ft.} \\
\text{Height of triangle} = & (3740 \div 136) \times 2 = & 27\tfrac{1}{2} \times 2 = 55 \text{ ft.}
\end{array}
$$

$$
\overset{\text{ft. in. ft. in. ft. in. \quad in. \quad in. \quad in. \quad cu. in.}}{(8)\ldots\quad 6\quad 3\times4\quad 3\times2\ 10\ =\ 75\times51\times34\ =\ 130050}
$$

Capacity of cistern, $130050 \div 277\cdot274 = 469\cdot0306$ gallons

$$(9)\ldots\text{Diameter of outer circle} = \overset{\text{ft.}}{15}+(\overset{\text{ft.}}{3}\times2) = \overset{\text{ft.}}{21} = 7 \text{ yds.}$$

$$\text{Area of walk} = (7+5)\times(7-5)\times\cdot7854$$

$$= 12\times2\times\cdot7854$$

$$= 18\cdot8496 \text{ sq. yds.}$$

$$= 18 \text{ sq. yds. } 7\cdot6464 \text{ sq. ft.}$$

$$(10)\ldots\quad\text{Circumference of well} = (\overset{\text{in.}}{34})^2\times\cdot7854$$

$$= 1156\times\cdot7854$$

$$= 907\cdot9224 \text{ sq. in.}$$

$$= 6\cdot305016 \text{ sq. ft.}$$

$$6\cdot305016 \text{ sq. ft.} \times 54\cdot5 \text{ ft.} = 343\cdot6234 \text{ cu. ft.}$$

EXERCISE XXIX.

$$
(1)\ldots\quad \overset{\text{in.}}{25}\ :\ \overset{\text{in.}}{22}\ ::\ \overset{\text{yds.}}{162\tfrac{1}{2}}\ :\ x
$$

$$x = \frac{1}{\cancel{25}}\times\frac{\overset{11}{\cancel{22}}}{1}\times\frac{\overset{13}{\cancel{325}}}{\cancel{2}} = 143 \text{ yds.}$$

$(2)\ldots$ 6 ac. 3 ro. 30 po. $22\tfrac{1}{2}$ sq. yds. = 33600 sq. yds.

Length of field = 33600 sq. yds. $\div$ 175 yds. = 192 yds.

$$\text{(3)...Area of yard } \overset{\text{ft. in. ft. in.}}{45 \ \ 10} \times \overset{}{26 \ \ 8} = \overset{\text{in. in.}}{550 \times 320} = \overset{\text{sq. in.}}{176000} = \overset{\text{sq. yds.}}{135\tfrac{85}{81}}$$

Area of each stone = 10 in. × 8 in. = 80 sq. in.

No. of stones required, 176000 ÷ 80 = 2200

Cost, $135\tfrac{85}{81}$ sq. yds. at 2s. 3d. per yd. = £15 5s. $6\tfrac{2}{3}d$.

(4)...Area of floor, $8\tfrac{3}{4}$ yds. × $6\tfrac{1}{2}$ yds. = $56\tfrac{7}{8}$ sq. yds. = $511\tfrac{7}{8}$ sq. ft.

Cost, $511\tfrac{7}{8}$ sq. ft. at 10d. per ft. = £21 6s. $6\tfrac{3}{4}d$.

(5)...

$$
\begin{array}{l}
365 \\
450 \\
535 \\
\hline
2)1350 \\
\hline
675
\end{array}
\qquad
\begin{array}{l}
675 - 365 = 310 \\
675 - 450 = 225 \\
675 - 535 = 140
\end{array}
$$

675 × 310 × 225 × 140 = 6591375000

Area of field = $\sqrt{6591375000}$ = 81186 sq. links

= 3 roods 9·89 perches

(6)...

$$\text{Area of semicircle} = \tfrac{1}{2}\{(21\tfrac{1}{2})^{2} \times 3\cdot1416\}$$
$$= \tfrac{1}{2}(462\cdot25 \times 3\cdot1416)$$
$$= \tfrac{1}{2}(1452\cdot2046)$$
$$= 726\cdot1023 \text{ sq. ft.}$$

(7)... 35 yds. × $22\tfrac{1}{2}$ yds. × 35 ft. = $9187\tfrac{1}{2}$ cubic yards

$$\text{(8)...Solidity, } \overset{\text{ft.}}{14\tfrac{1}{2}} \times \overset{\text{ft.}}{1\tfrac{5}{6}} \times \overset{\text{ft.}}{1\tfrac{1}{4}} = \overset{\text{cu. ft.}}{33\tfrac{11}{48}} = 33 \text{ cu. ft. } 396 \text{ cu. in.}$$

Value, $33\tfrac{11}{48}$ cu. ft. at 2s. 8d. per ft. = £4 8s. $7\tfrac{1}{3}d$.

(9)... Depth of box $= \sqrt[3]{3\frac{3}{8}} = \sqrt[3]{\frac{27}{8}} = \frac{3}{2}$ ft. $= 18$ in.

(10)...

$$\text{Area of interior surface} = 1\frac{1}{2} \times 1\frac{1}{2} \times 6$$
$$= 2\frac{1}{4} \text{ sq. ft.} \times 6$$
$$= 13\frac{1}{2} \text{ sq. ft.}$$

EXERCISE XXX.

(1)...

ft.	in.	
82	6	
56	3	
4620	0	
20	7	6
9)4640	7	6
515$\frac{5}{8}$ sq. yds.		

515$\frac{5}{8}$ sq. yds. at 3s. 4d. per yd. $= £85$ 18s. 9d.

(2)...
$$\overset{\text{ft.}}{10\tfrac{1}{2}} \; : \; \overset{\text{ft.}}{11\tfrac{1}{4}} \; :: \; \overset{\text{yds.} \quad \text{in.}}{175 \times 22\tfrac{1}{2}} \; : \; \overset{\text{yds.} \quad \text{in.}}{x \times 25}$$

$$x = (11\tfrac{1}{4} \times 175 \times 22\tfrac{1}{2}) \div (10\tfrac{1}{2} \times 25)$$

$$= \frac{45}{4} \times \frac{\overset{7}{\cancel{175}}}{1} \times \frac{\overset{15}{\cancel{45}}}{\cancel{2}} \times \frac{\cancel{2}}{\underset{3}{\cancel{21}}} \times \frac{1}{\cancel{25}}$$

$$= \tfrac{675}{4} \text{ yds.} = 168\tfrac{3}{4} \text{ yds.}$$

(3)... Perpendicular of triangle $= \overset{\text{sq. ft.} \quad \text{ft.}}{(48\tfrac{1}{6} \div 8\tfrac{1}{2})} \times 2$
$$= 5\tfrac{2}{3} \text{ ft.} \times 2$$
$$= 11\tfrac{1}{3} \text{ ft.} = 136 \text{ in.}$$

Hypotenuse of triangle $= \sqrt{136^2 + 102^2}$
$$= \sqrt{18496 + 10404}$$
$$= \sqrt{28900}$$
$$= 170 \text{ in.} = 14 \text{ ft. } 2 \text{ in.}$$

(4)...

$$\text{Major axis} = 25 \times 2 = 50 \text{ ft.}$$

$$\text{Minor axis} = 18 \times 2 = 36 \text{ ft.}$$

$$\text{Area of ellipse} = \overset{\text{ft.}}{50} \times \overset{\text{ft.}}{36} \times \cdot 7854$$

$$= 1413 \cdot 72 \text{ sq. ft.}$$

$$= 157 \cdot 08 \text{ sq. yds.}$$

(5)...

$$\tfrac{3}{4} \text{ of an acre} = 3630 \text{ sq. yds.}$$

$$\text{Diameter of circle} = \sqrt{3630 \div \cdot 7854}$$

$$= \sqrt{4621 \cdot 848739}$$

$$= 67 \cdot 984 \text{ yds.}$$

(6)...If 1 represent the side of the larger field, then $\tfrac{4}{5}$ will represent the side of the smaller field, and $(\tfrac{4}{5})^2$ or $\tfrac{16}{25}$ its area.

$$1 + \tfrac{16}{25} = \tfrac{41}{25}$$

10 ac. 3 ro. 36 per. 17 sq. yds. = 53136 sq. yds.

$$\tfrac{41}{25} \quad : \quad 1 \quad :: \quad \overset{\text{sq. yds.}}{53136} \quad : \quad \text{area of larger field}$$

$$\text{Area} = \frac{25}{\cancel{41}} \times \frac{\overset{1296}{\cancel{53136}}}{1} = \overset{\text{sq. yds.}}{32400} = \overset{\text{ac.}}{6} \; \overset{\text{ro.}}{2} \; \overset{\text{per.}}{31} \; \overset{\text{sq.yds.}}{2\tfrac{1}{4}}$$

ac.	ro.	per.	sq. yds.
10	3	36	17
6	2	31	$2\tfrac{1}{4}$
Area of smaller field, 4	1	5	$14\tfrac{3}{4}$

(7)...

$$\text{Contents of block,} \; \overset{\text{ft.}}{4\tfrac{1}{2}} \times \overset{\text{ft.}}{1\tfrac{1}{2}} \times \overset{\text{ft.}}{1\tfrac{1}{4}} = 8\tfrac{7}{16} \text{ cu. ft.}$$

$$\text{Weight} = \overset{\text{lb.}}{168} \times 8\tfrac{7}{16} = \overset{\text{lb.}}{1417\tfrac{1}{2}} = \overset{\text{cwt.}}{12} \; \overset{\text{qrs.}}{2} \; \overset{\text{lb.}}{17\tfrac{1}{2}}$$

$$(8)...\quad \text{Mean width} = \overset{\text{ft.}}{(34} + \overset{\text{ft.}}{65)} \div 2 = \overset{\text{ft.}}{49\tfrac{1}{2}} = \overset{\text{yds.}}{16\tfrac{1}{2}}$$

$$\tfrac{5}{8} \text{ of a mile} = 1100 \text{ yds.}$$

$$\text{Earth removed} = \overset{\text{yds.}}{1100} \times \overset{\text{yds.}}{16\tfrac{1}{2}} \times \overset{\text{yds.}}{6} = 108900 \text{ cu. yds.}$$

$$(9)...\qquad \text{Base of pyramid} = \overset{\text{ft.}}{4\tfrac{1}{2}} \times \overset{\text{ft.}}{4\tfrac{1}{2}} = \overset{\text{sq. ft.}}{20\tfrac{1}{4}}$$

$$\text{Solidity} = \tfrac{1}{3}(20\tfrac{1}{4} \text{ sq. ft.} \times 12 \text{ ft.})$$

$$= \tfrac{1}{3} \text{ of } 243 \text{ cu. ft.}$$

$$= 81 \text{ cu. ft.}$$

$$(10)...\text{Capacity of box} = \overset{\text{ft.}}{5\tfrac{1}{2}} \times \overset{\text{ft.}}{3\tfrac{1}{2}} \times \overset{\text{ft.}}{2\tfrac{1}{3}} = \overset{\text{in.}}{66} \times \overset{\text{in.}}{42} \times \overset{\text{in.}}{28} = \overset{\text{cu. in.}}{77616}$$

$$\text{Space required for each book } \overset{\text{in.}}{10\tfrac{1}{2}} \times \overset{\text{in.}}{6} \times \overset{\text{in.}}{1\tfrac{3}{4}} = 110\tfrac{1}{4} \text{ cu. in.}$$

$$\text{No. of books} = 77616 \div 110\tfrac{1}{4} = 704$$

EXERCISE XXXI.

(1)...

	ft.	′	″		
17·875 ft. =	17	10	6		
	10	4	6		
	178	9	0		
	5	11	6		
		8	11	3	
2)185·	5	5	3		
92ſ	8′	8″	7‴	6⁗	

$$= 92 \text{ sq. ft. } 104\tfrac{5}{8} \text{ sq. in.}$$

(2)...30 ft. 4 in. = 364 in.   22 ft. 9 in. = 273 in.

Diameter of parallelogram $= \sqrt{364^2 + 273^2}$

$$= \sqrt{132496 + 74529}$$

$$= \sqrt{207025}$$

$$= 455 \text{ in.}$$

$$= 37 \text{ ft. } 11 \text{ in.}$$

(3)...   Width of field $= \sqrt{1065^2 - 852^2}$

$$= \sqrt{1134225 - 725904}$$

$$= \sqrt{408321}$$

$$= 639 \text{ links}$$

$$\text{Area of field} = \overset{\text{li.}}{852} \times \overset{\text{li.}}{639} = 544428 \text{ sq. links}$$

$$= 5 \text{ ac. } 1 \text{ ro. } 31\cdot0848 \text{ po.}$$

(4)...See figure in *Exercise X.* (7)

Perpendicular of triangle $= \sqrt{(52\frac{1}{2})^2 - 42^2}$

$$= \sqrt{2756\cdot25 - 1764}$$

$$= \sqrt{992\cdot25}$$

$$= 31\cdot5 \text{ ft.}$$

Area of triangle $= 31\cdot5 \text{ ft.} \times 42 \text{ ft.}$

$$= 1323 \text{ sq. ft.}$$

$$= 147 \text{ sq. yds.}$$

(5)...   Breadth of street $= \sqrt{62^2 - 48^2}$

$$= \sqrt{3844 - 2304}$$

$$= \sqrt{1540}$$

$$= 39\cdot2428 \text{ ft.}$$

$$\text{(6)...} \quad \text{Perimeter of room} = \overset{\text{yds.} \quad \text{yds.}}{(6\tfrac{1}{4}+4\tfrac{3}{4})} \times 2 = 22 \text{ yds.}$$

Area of walls $= 22$ yds. $\times 3\tfrac{1}{2}$ yds. $= 77$ sq. yds. $= 693$ sq. ft.

Area of 1 piece of paper $= 3$ ft. $\times 1\tfrac{5}{6}$ ft. $\times 12 = 66$ sq. ft.

Quantity of paper required, $693 \div 66 = 10\tfrac{1}{2}$ pieces

$10\tfrac{1}{2}$ pieces at 5s. 6d. per piece $= £2$ 17s. 9d.

(7)...See Euclid, Book I. Proposition xxxii. Cor. 1.

9 angles of nonagon $+ 4$ rt. angles $= 18$ rt. angles

9 angles of nonagon $= 14$ rt. angles

Each angle of nonagon $= \tfrac{14}{9}$ of a rt. angle

$= \tfrac{14}{9}$ of $90°$

$= 140°$

(8)...See Appendix, page 179.

Area of plantation $= 375^2 \times ·07958$

$= 140625$ sq. yds. $\times ·07958$

$= 11190·9375$ sq. yds.

$= 2$ ac. 1 ro. 9 po. $28\tfrac{11}{16}$ sq. yds.

(9)...   3 cu. ft. $= 5184$ cu. in.

15 in. $\times 13\tfrac{1}{2}$ in. $= 202\tfrac{1}{2}$ sq. in.

Length required, 5184 cu. in. $\div 202\tfrac{1}{2}$ sq. in. $= 25\tfrac{3}{5}$ in.

(10)...Contents of stone, $6\tfrac{3}{4}$ ft. $\times 3\tfrac{1}{8}$ ft. $\times 2\tfrac{1}{4}$ ft. $= 46\tfrac{5}{16}$ cu. ft.

Weight of stone, 156 lb. $\times 46\tfrac{5}{16} = 7224\tfrac{3}{4}$ lb.

$= 3$ tons 4 cwt. 2 qrs. $0\tfrac{3}{4}$ lb.

EXERCISE XXXII.

(1)...

$$5\tfrac{1}{4}$$
$$4$$
$$2\tfrac{3}{4}$$
$$2\overline{)12}$$
$$\overline{6}$$
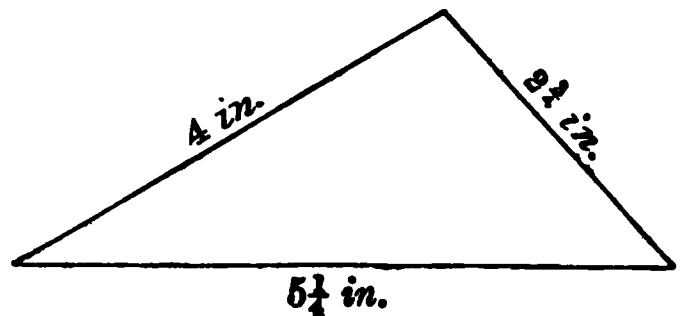
$6 - 5\tfrac{1}{4} = \tfrac{3}{4}, \qquad 6 - 4 = 2, \qquad 6 - 2\tfrac{3}{4} = 3\tfrac{1}{4}$

$6 \times \tfrac{3}{4} \times 2 \times 3\tfrac{1}{4} = 29\tfrac{1}{4} = 29\cdot25$

Area of triangle $= \sqrt{29\cdot25} = 5\cdot4083$ sq. in.

(2)... Top and bottom, $4\tfrac{2}{3}$ ft. $\times 2\tfrac{1}{2}$ ft. $\times 2 = 23\tfrac{1}{3}$ sq. ft.
Two sides ....$4\tfrac{2}{3}$ ft. $\times 2\tfrac{1}{4}$ ft. $\times 2 = 21$ sq. ft.
Two ends......... $2\tfrac{1}{2}$ ft. $\times 2\tfrac{1}{4}$ ft. $\times 2 = 11\tfrac{1}{4}$ sq. ft.
Quantity of tin required............... $55\tfrac{7}{12}$ sq. ft.

(3)...Cost of fencing each side of larger garden, £1 2s. 6d.
  „   „   „ smaller garden,   15s. 9d.

Ratio of sides, $22\tfrac{1}{2}$: $15\tfrac{3}{4}$

90 : 63

10 : 7

Ratio of areas, 100 : 49

(4)...Surface of each side$=10$ sq. ft. $1\tfrac{1}{2}$ sq. in.$\div 6 = 240\tfrac{1}{4}$ sq. in.

Length of edge $= \sqrt{240\tfrac{1}{4}} = \sqrt{\tfrac{961}{4}} = \tfrac{31}{2} = 15\tfrac{1}{2}$ in.

yds. in. ft. ft.
(5)...Area of each plank, $6\tfrac{1}{4} \times 10 = 18\tfrac{3}{4} \times \tfrac{5}{6} = 15\tfrac{5}{8}$ sq. ft.

Area of 45 planks, $15\tfrac{5}{8}$ sq. ft. $\times 45 = 703\tfrac{1}{8}$ sq. ft.

Value, $703\tfrac{1}{8}$ sq. ft. at 8d. per ft. $= £23$ 8s. 9d.

$$\text{(6)}\dots \text{Perimeter of room, } (18\tfrac{3}{4}+15)\times 2 = 67\tfrac{1}{2} \text{ ft.}$$

$$\text{Area of walls, } 67\tfrac{1}{2} \text{ ft.} \times 12\tfrac{3}{4} \text{ ft.} = 860\tfrac{5}{8} \text{ sq. ft.}$$

$$860\tfrac{5}{8} \text{ sq. ft.} -\tfrac{1}{6}(860\tfrac{5}{8} \text{ sq. ft.}) = 717\tfrac{3}{16} \text{ sq. ft.}$$

$$\text{Area of 1 piece of paper, } 3 \text{ ft.} \times 1\tfrac{7}{8}\text{ft.} \times 12 = 67\tfrac{1}{2} \text{ sq. ft.}$$

$$\text{Paper required, } 717\tfrac{3}{16}+67\tfrac{1}{2} = 10\tfrac{5}{8} \text{ pieces}$$

$$\text{Cost, } 10\tfrac{5}{8} \text{ pieces at } 7s.\ 6d. \text{ per piece} = £3\ 19s.\ 8\tfrac{1}{4}d.$$

$$\text{(7)}\dots\text{Capacity of box, } 5\tfrac{1}{2}\times 3\tfrac{1}{2}\times 2\tfrac{1}{4}\times 324 = 14033\tfrac{1}{4} \text{ cu. in.}$$

$$31\tfrac{1}{2} \text{ in.} \times 22 \text{ in.} = 693 \text{ sq. in.}$$

$$\text{Required depth, } 14033\tfrac{1}{4} \text{ cu. in} +693 \text{ sq. in.} = 20\tfrac{1}{4} \text{ in.}$$

(8)...See Appendix, page 180

$$\text{Surface of sphere} = (3\cdot5)^2 \times 3\cdot1416$$
$$= 12\cdot25 \text{ sq. ft.} \times 3\cdot1416$$
$$= 38\cdot4846 \text{ sq. ft.}$$

$$\text{(9)}\dots \quad \text{Volume of sphere} = (25)^3 \times \cdot5236$$
$$= 15625 \text{ cu. in.} \times \cdot5236$$
$$= 8181\cdot25 \text{ cu. in.}$$

$$\text{(10)}\dots \quad \text{Diameter of sphere} = \sqrt[3]{33510\cdot4 + \cdot5236}$$
$$= \sqrt[3]{64000}$$
$$= 40 \text{ in.}$$

EXERCISE XXXIII.

(1)...   Area of floor, $29\frac{1}{4}$ ft. × $23\frac{1}{3}$ ft. = $682\frac{1}{2}$ sq. ft.

Area of 1 yd. carpeting, 3 ft. × $2\frac{1}{3}$ ft. = 7 sq. ft.

Carpeting required, $682\frac{1}{2} \div 7 = 97\frac{1}{2}$ yds.

Cost, $97\frac{1}{2}$ yds. at 3s. 10d. per yd. = £18 13s. 9d.

(2)...

$$
\begin{array}{r}
\text{ft.} \quad ' \quad '' \\
7\text{·}875 \text{ yds.} = 23 \quad 7 \quad 6 \\
16 \quad 10 \\
\hline
378 \quad 0 \quad 0 \\
19 \quad 8 \quad 3 \\
\hline
2)397 \quad 8 \quad 3 \\
\hline
9)198 \quad 10 \quad 1\frac{1}{2} \\
\hline
22 \text{ sq. yds. } 121\frac{1}{2} \text{ sq. in.}
\end{array}
$$

(3)...Circumference of wheel, 4 ft. $1\frac{1}{2}$ in. × 3·1416 = 12·9591 ft.

Distance travelled, 12·9591 ft. × 25000 = 107992·5 yds.

$$= 61 \text{ mi. } 632\frac{1}{2} \text{ yds.}$$

(4)... $27\frac{1}{3}$ ac. = 133100 sq. yds.

Length of diagonal path = $\sqrt{133100 \times 2}$

$$= \sqrt{266200}$$

$$= 515\text{·}9457 \text{ yds.}$$

(5)...AC = $\sqrt{(11\text{·}625)^2 + (15\text{·}5)^2}$

$$= \sqrt{135\text{·}140625 + 240\text{·}25}$$

$$= \sqrt{375\text{·}390625}$$

$$= 19\text{·}375 \text{ miles}$$

$$= 19 \text{ miles } 3 \text{ furlongs}$$
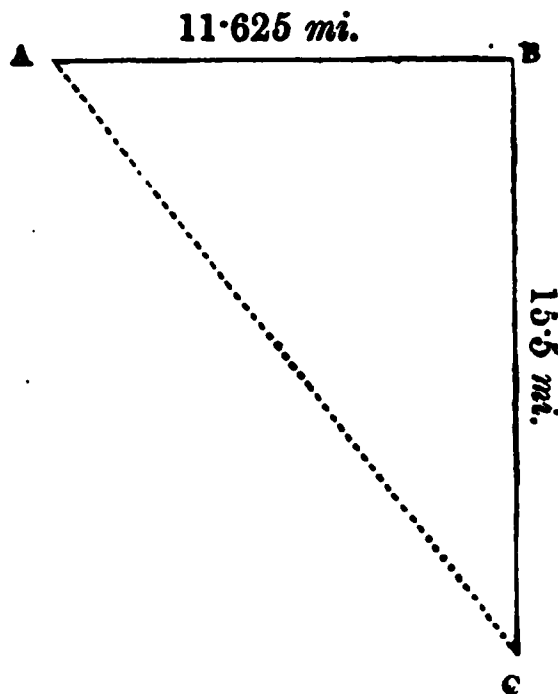
(6)...   Area of yard, £33 16s.÷2s. 3d. = 300$\frac{4}{9}$ sq. yds.

$$= 2704 \text{ sq. ft.}$$

Length of side = $\sqrt{2704}$ = 52 ft.

(7)...Area of grass plot = 20 yds. × 20 yds. = 400 sq. yds.

Area of flower bed = $6^2 \times \cdot 7854$ = 28·2744 sq. yds.

400 sq. yds.—28·2744 sq. yds. = 371·7256 sq. yds.

(8)...AB = 65 yds.+(8×2) = 211 ft.
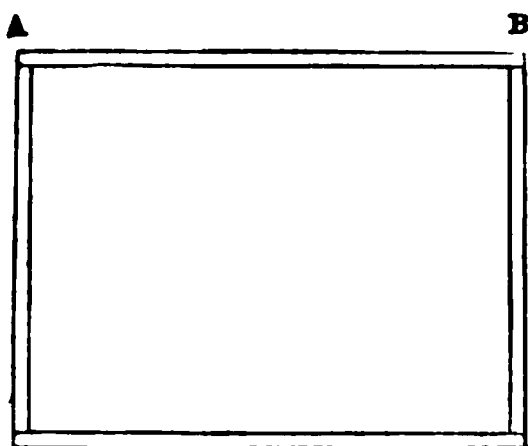
$$211 \text{ ft.} \times 8 \text{ ft.} \times 2 = 3376 \text{ sq. ft.}$$
$$150 \text{ ft.} \times 8 \text{ ft.} \times 2 = 2400 \text{ sq. ft.}$$
$$\text{Area of paths ...} = \overline{5776} \text{ sq. ft.}$$

Quantity of gravel required = 5776 sq. ft. × $\frac{1}{6}$ ft.

$$= 962\frac{2}{3} \text{ cu. ft.}$$

$$= 35 \text{ cu. yds. } 17\frac{2}{3} \text{ cu. ft.}$$

(9)...   Capacity of cistern, $5\frac{5}{8} \times 2\frac{5}{8} \times 3\frac{1}{6}$ = $50\frac{15}{32}$ cu. ft.

Weight of water, 1000 oz. × $50\frac{15}{32}$ = $50468\frac{3}{4}$ oz.

$$= 1 \text{ ton } 8 \text{ cwt. } 18 \text{ lb. } 4\frac{3}{4} \text{ oz.}$$

(10)...   Edge of cube = $\sqrt[3]{21952}$ = 28 in.

Surface of box = $(28)^2 + 6$ in.

$$= 784 \text{ sq. in.} \times 6$$

$$= 4704 \text{ sq. in.}$$

$$= 32\frac{2}{3} \text{ sq. ft.}$$

Cost of painting, $32\frac{2}{3}$ sq. ft. at $2\frac{1}{4}d$. per ft. = 6s. 1$\frac{1}{2}d$.

EXERCISE XXXIV.

(1)... 3 angles of triangle = 180°

Vertical angle = 40·9375°

2)139·0625°

Each equal angle = 69·53125° = 69° 31′ 52·5″

60

31·87500′

60

52·50000″

(2)...
$$\begin{array}{ccc} \text{ch.} & \text{ch.} & \text{ch.} \\ 9{\cdot}75 + 11{\cdot}55 & = & 21{\cdot}3 \end{array}$$

14·8

1704

852

213

2)315·24

10)157·62 sq. chains

15·762 ac. = 15 ac. 3 ro. 1·92 po.

4

3·048 ro.

40

1·920 po.

(3)... 8 ch. 45 li. = 8·45 chains

1 ch. 75 li. + 2 ch. 55 li. = 4·3

2535

3380

2)36·335

10)18·1675 sq. chains

1·81675 ac. = 1 ac. 3 ro. 10·68 po.

4

3·26700 ro.

40

10·68000 po.

G G

(4)... Hypotenuse of triangle $= \sqrt{(27\frac{1}{2})^2 + 150^2}$

$$= \sqrt{756\cdot25 + 22500}$$

$$= \sqrt{23256\cdot25}$$

$$= 152\cdot5 \text{ in.}$$

$$= 12 \text{ ft. } 8\frac{1}{2} \text{ in.}$$

(5)...Area of 6 floors, $18\frac{3}{4}$ ft. $\times 14\frac{2}{3}$ ft. $\times 6 = 1650$ sq. ft.

Area of each plank, $12\frac{1}{2}$ ft. $\times 11$ in. $= 11\frac{11}{24}$ sq. ft.

No. of planks required, $1650 \div 11\frac{11}{24} = 144$

Cost, 1650 sq. ft. at $8d.$ per sq. ft. $= £55$

(6)...

$$\text{Area of plot} = \overset{\text{ft.}}{(40)^2} \times \cdot7854$$

$$= 1600 \text{ sq. ft.} \times \cdot7854$$

$$= 1256\cdot64 \text{ sq. ft.}$$

$$= 139\frac{47}{75} \text{ sq. yds.}$$

Cost, $139\frac{47}{75}$ sq. yds. at $7\frac{1}{2}d.$ per. yd. $= £4$ $7s.$ $3\frac{1}{8}d.$

(7)...

$$7\frac{1}{4} \text{ ft.} \times 3\frac{2}{3} \text{ ft.} = 26\frac{7}{12} \text{ sq. ft.}$$

Depth of cistern, 87 cu. ft. $\div 26\frac{7}{12}$ sq. ft. $= 3\frac{3}{11}$ ft.

(8)...

$$\text{Area of circle} = \overset{\text{in.}}{(20)^2} \times \cdot7854$$

$$= 400 \text{ sq. in.} \times \cdot7854$$

$$= 314\cdot16 \text{ sq. in.}$$

Capacity of hamper $= 314\cdot16$ sq. in. $\times 28$ in. $= 8796\cdot48$ c. in.

$$= 5 \text{ c. ft. } 156\cdot48 \text{ c. in.}$$

(9)...
$$
\begin{array}{l}
\text{ft.} \\
2\frac{1}{2} \\
2 \\
\underline{1\frac{1}{2}} \\
2)\overline{6} \\
\overline{3}
\end{array}
\qquad
\begin{array}{l}
3-2\frac{1}{2} = \frac{1}{2} \\
3-2 \ \ = 1 \\
3-1\frac{1}{2} = 1\frac{1}{2}
\end{array}
$$

$$3 \times \tfrac{1}{2} \times 1 \times 1\tfrac{1}{2} = 2\tfrac{1}{4}$$

Area of base $= \sqrt{2\tfrac{1}{4}} = \sqrt{\tfrac{9}{4}} = \tfrac{3}{2} = 1\tfrac{1}{2}$ sq. ft.

Solidity of prism $= 1\tfrac{1}{2}$ sq. ft. $\times 8\tfrac{1}{2}$ ft. $= 12\tfrac{3}{4}$ cu. ft.

(10)... Capacity of cart, 80 in. $\times$ 54 in. $\times$ 24 in. $=103680$ cu. in.

Contents of each slate, 16 in. $\times$ 9 in. $\times \tfrac{3}{16}$ in. $= 27$ cu. in.

No. of slates, $103680 \div 27 = 3840$

EXERCISE XXXV.

(1)...See *Exercise XX.* (1)

$$
\begin{array}{lll}
90^\circ & 0' & 0'' \\
44^\circ & 18' & 32'' \\
\hline
\end{array}
$$
Comp. $= 45^\circ \ 41' \ 28''$

$$
\begin{array}{lll}
90^\circ & 0' & 0'' \\
63^\circ & 26' & 38'' \\
\hline
\end{array}
$$
Comp. $= 26^\circ \ 33' \ 22''$

$$
\begin{array}{lll}
180^\circ & 0' & 0'' \\
72^\circ & 25' & 16'' \\
\hline
\end{array}
$$
Supp. $= 107^\circ \ 34' \ 44''$

$$
\begin{array}{lll}
180^\circ & 0' & 0'' \\
110^\circ & 46' & 33'' \\
\hline
\end{array}
$$
Supp. $= 69^\circ \ 13' \ 27''$

(2)...Area of field $= \overset{\text{yds.} \ \text{yds.}}{136 \times 95} = 12920$ sq. yds.

$$
\begin{array}{l}
= 2 \text{ ac. } 2 \text{ ro. } 27 \text{ po. } 3\tfrac{1}{4} \text{ sq. yds.} \\
\tfrac{3}{8} \text{ of an acre} = \underline{\qquad 1 \text{ ro. } 20 \text{ po.}} \\
\text{Area of remainder} = 2 \text{ ac. } 1 \text{ ro. } 7 \text{ po } 3\tfrac{1}{4} \text{ sq. yds.}
\end{array}
$$

G G 2

(3)...

$$
\begin{array}{r}
124{\cdot}5 \\
97{\cdot}5 \\
86{\cdot}5 \\
\hline
2)308{\cdot}5 \\
\hline
154{\cdot}25
\end{array}
$$

$$154{\cdot}25 - 124{\cdot}5 = 29{\cdot}75$$
$$154{\cdot}25 - \ \ 97{\cdot}5 = 56{\cdot}75$$
$$154{\cdot}25 - \ \ 86{\cdot}5 = 67{\cdot}75$$

$$154{\cdot}25 \times 29{\cdot}75 \times 56{\cdot}75 \times 67{\cdot}75 = 17643604{\cdot}26171875$$

Area of field $= \sqrt{17643604{\cdot}26171875} = 4200{\cdot}4295$ sq. yds.

(4)...$\underset{\text{ft.}}{20\tfrac{1}{4}} \times \underset{\text{ft.}}{16\tfrac{1}{2}}$: $\underset{\text{ft.}}{27\tfrac{3}{4}} \times \underset{\text{ft.}}{21\tfrac{1}{2}}$ :: $\underset{£}{7} \quad \underset{s.}{8} \quad \underset{d.}{6} = \underset{d.}{1782}$: x

$$x = (27\tfrac{3}{4} \times 21\tfrac{1}{2} \times 1782) \div (20\tfrac{1}{4} \times 16\tfrac{1}{2})$$
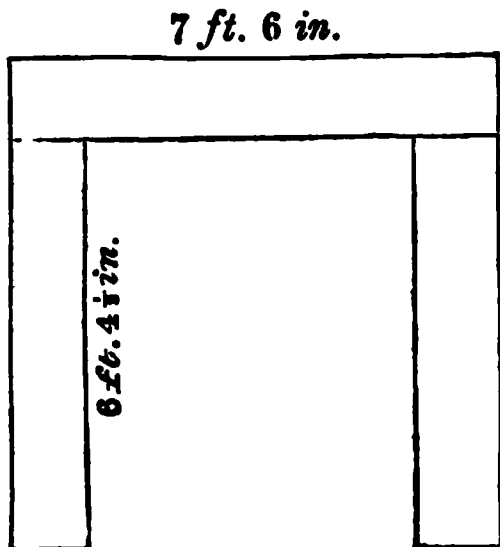
$$= \frac{\overset{37}{\cancel{111}}}{\cancel{4}} \times \frac{43}{\cancel{2}} \times \frac{\overset{2}{\cancel{1782}}}{1} \times \frac{\cancel{4}}{\cancel{81}} \times \frac{\cancel{2}}{\underset{\underset{3}{\cancel{3}}}{\cancel{33}}}$$

$$= 3182d. = £13 \ 5s. \ 2d.$$

7 ft. 6 in.

6 ft. 4½ in.

(5)...

	ft.	in.	in.		sq. ft.
	7	6 $\times 13\tfrac{1}{2}$		$=$	$8\tfrac{7}{16}$
	6	$4\tfrac{1}{2} \times 13\tfrac{1}{2}$	$\times 2$	$=$	$14\tfrac{11}{32}$
					$\overline{22\tfrac{25}{32}}$

$22\tfrac{25}{32}$ sq. ft. $\times 4 = 91\tfrac{1}{8}$ sq. ft.

(6)...   Area of oval $= 125$ yds. $\times 75$ yds $\times {\cdot}7854$

$$= 9375 \text{ sq. yds.} \times {\cdot}7854$$

$$= 7363{\cdot}125 \text{ sq. yds.}$$

$$= 7363\tfrac{1}{8} \text{ sq. yds.}$$

(7)... 8 ft. $\times 4\tfrac{1}{2}$ ft. $\times 3\tfrac{1}{4}$ ft. $= 117$ cu. ft. $= 202176$ cu. in.

Capacity of cistern, $202176 \div 277{\cdot}274 = 729{\cdot}1559$ gallons.

(8)...See Appendix, page 180.

$$\text{Area of mound} = \tfrac{1}{2}(20^2 \times 3{\cdot}1416)$$
$$= \tfrac{1}{2}(400 \times 3{\cdot}1416)$$
$$= \tfrac{1}{2}(1256{\cdot}64)$$
$$= 628{\cdot}32 \text{ sq. ft.}$$

(9)...

$$\text{Silk required} = 25^2 \times 3{\cdot}1416$$
$$= 625 \text{ sq. ft.} \times 3{\cdot}1416$$
$$= 1963{\cdot}5 \text{ sq. ft.}$$
$$= 218\tfrac{1}{6} \text{ sq. yds.}$$

$$\text{Gas required} = 25^3 \times {\cdot}5236$$
$$= 15625 \text{ cu. ft.} \times {\cdot}5236$$
$$= 8181\tfrac{1}{4} \text{ cu. ft.}$$

(10)...

$$\text{Area of mouth of well} = (3\tfrac{1}{2})^2 \text{ft.} \times {\cdot}7854$$
$$= 12{\cdot}25 \text{ sq. ft.} \times {\cdot}7854$$
$$= 9{\cdot}62115 \text{ sq. ft.}$$

$$9{\cdot}62115 \text{ sq. ft.} \times 180 \text{ ft.} = 1731{\cdot}807 \text{ cu. ft.}$$

EXERCISE XXXVI.

(1)...

$$55 \text{ yds.} \times 34 \text{ yds.} = 1870 \text{ sq. yds.}$$
$$(55+18) \times (34+15) = 73 \text{ yds.} \times 49 \text{ yds.} = 3577 \text{ sq. yds.}$$
$$3577 \text{ sq. yds.} - 1870 \text{ sq. yds.} = 1707 \text{ sq. yds.}$$

(2)...   Slant height of roof

$$= \sqrt{5^2 + (3 \cdot 75)^2}$$
$$= \sqrt{25 + 14 \cdot 0625}$$
$$= \sqrt{39 \cdot 0625}$$
$$= 6 \cdot 25 = 6\tfrac{1}{4} \text{ yds.}$$
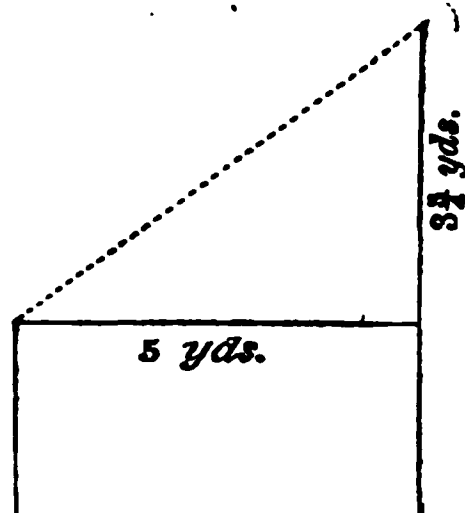
Area of roof $= 12$ yds. $\times 6\tfrac{1}{4}$ yds. $= 75$ sq. yds.

(3)...   Let $5x =$ length of room, in feet

then $4x =$ breadth   „   „

and $2x =$ height   „   „

$$5x \times 4x \times 2x = 40x^3 = 5000$$
$$\therefore x^3 = 125$$
$$\text{and } x = 5$$

Hence, length of room $= 5x = 25$ feet

breadth   „ $= 4x = 20$ „

height   „ $= 2x = 10$ „

Area of floor $= 25$ ft. $\times 20$ ft. $= 500$ sq. ft.

Cost of carpet, 500 sq. ft. at 4s. 6d. per sq. yd. $= £12$ 10s.

(4)...   Perimeter of room $= \overset{\text{ft.}}{(25} + \overset{\text{ft.}}{20)} \times 2 = 90$ ft.

Area of walls, 90 ft. $\times 10$ ft. $= 900$ sq. ft. $= 100$ sq. yds.

Area of 1 piece of paper $= 3$ ft. $\times 2\tfrac{1}{4}$ ft. $\times 12 = 81$ sq. ft.

$= 9$ sq. yds.

Paper required, $100 \div 9 = 11\tfrac{1}{9}$ pieces

Cost, $11\tfrac{1}{9}$ pieces at 6s. 6d. per piece $= £3$ 12s. $2\tfrac{2}{3}d.$

(5)... Mean width of ditch $= \frac{1}{2}(3\frac{1}{2}^{ft.}+2\frac{1}{2}^{ft.}) = 3$ ft.

2160 ft. × 3 ft. × 2 ft. = 12960 cu. ft. = 480 cu. yds.

Each labourer digs 8 cu. yds. × 6 = 48 cu. yds. in the week

No. of labourers required, 480 ÷ 48 = 10

(6)... 10 angles of decagon + 4 rt. angles = 20 rt. angles

10 angles of decagon = 16 rt. angles

Each angle of decagon $= \frac{8}{5}$ of a rt. angle

$= \frac{8}{5}$ of 90°

= 144°

(7)... Area of grass plot = 20 yds. × 15 yds. = 300 sq. yds.

Area of flower-bed = 16 ft. × 12 ft. × ·7854

= 192 sq. ft. × ·7854

= 150·7968 sq. ft.

= 16·7552 sq. yds.

300 sq. yds. − 16·7552 sq. yds. = 283·2448 sq. yds.

(8)... Area of walk $= (20\frac{1}{2}^{ft.}+13\frac{1}{2}^{ft.}) \times (20\frac{1}{2}^{ft.}-13\frac{1}{2}^{ft.}) \times$ ·7854

= 34 ft. × 7 ft. × ·7854

= 238 sq. ft. × ·7854

= 186·9252 sq. ft.

(9)... Section of pillar $= (3\frac{1}{8}^{ft.})^2 \times$ ·07958

= 9·765625 sq. ft. × ·07958

= ·7771484375 sq. ft.

Contents of pillar = ·7771484375 sq. ft. × 16 ft.

= 12·434375 cu. ft.

= 12 cu. ft. $750\frac{3}{8}$ cu. in.

(10)...   Contents of ball $= 2^3 \times \cdot 5236$

$= 4 \cdot 1888$ cu. in.

cu. in.		cu. in.		oz.		oz.
$\cdot 1728$	:	$4 \cdot 1888$	::	1825	:	$4 \cdot 4239$, weight of ball

EXERCISE XXXVII.

(1)...   24 ac. 26 per. $17\frac{1}{2}$ sq. yds. $= 116964$ sq. yds.

Length of side of field $= \sqrt{116964} = 342$ yds.

(2)...

ft.	′	″	
19	8	6	
13	7	10	
256	2	6	
11	5	11	6
1	4	5	1

269 ft. $0'$ $10''$ $7''' = 269$ sq. ft. $10\frac{7}{13}$ sq. in.

(3)... $2\frac{3}{4}$ miles $= 4840$ yds. $1\frac{3}{4}$ mile $= 3080$ yds.

No. of acres $= \dfrac{\cancel{4840} \times 3080}{\cancel{4840}} = 3080$

(4)... $BD = \sqrt{AB^2 - AD^2}$

$= \sqrt{85^2 - 84^2}$

$= \sqrt{7225 - 7056}$

$= \sqrt{169}$

$= 13$ yds.

Area of triangle $= 84$ yds. $\times 13$ yds. $= 1092$ sq. yds.

(5)...   Superficies of cube $= (13\frac{1}{2})^2 \times 6$

$= 182\frac{1}{4}$ sq. in. $\times 6$

$= 1093\frac{1}{2}$ sq. in.

$= 7$ sq. ft. $85\frac{1}{2}$ sq. in.

(6)... Area of ground $= 125\frac{1}{2}$ ft. $\times 109\frac{1}{2}$ ft.

$= 13742\frac{1}{4}$ sq. ft.

$= 1526\frac{11}{12}$ sq. yds.

$$\begin{array}{ccccccccc} \text{sq. yds.} & & \text{sq. yd.} & & \pounds & s. & d. & s. & \\ 1526\frac{11}{12} & : & 1 & :: & 229 & 0 & 9=4580\frac{3}{4} & : & \text{cost per sq. yd.} \end{array}$$

$$\text{Cost per sq. yd.} = \frac{\overset{3}{\cancel{12}}}{\cancel{18323}} \times \frac{\cancel{18323}}{\cancel{4}} = 3 \text{ shillings}$$

(7)...

$OA = 8\frac{1}{4}$ mi. $\times 20 = 165$ mi.

$OB = 11$ mi. $\times 20 = 220$ mi.

$AB = \sqrt{OA^2 + OB^2}$

$= \sqrt{165^2 + 220^2}$

$= \sqrt{27225 + 48400}$

$= \sqrt{75625}$

$= 275$ miles

(8)...   Area of ring $= (29{\cdot}5 + 25{\cdot}5) \times (29{\cdot}5 - 25{\cdot}5) \times {\cdot}7854$

$$= 55 \text{ ft.} \times 4 \text{ ft.} \times {\cdot}7854$$

$$= 220 \text{ sq. ft.} \times {\cdot}7854$$

$$= 172{\cdot}788 \text{ sq. ft.}$$

(9)...   Area of circle $= 25^2 \times 3{\cdot}1416$

$$= 625 \text{ sq. ft.} \times 3{\cdot}1416$$

$$= 1963{\cdot}5 \text{ sq. ft.}$$

$$360° \;:\; 66° \;::\; \underset{\text{sq. ft.}}{1963{\cdot}5} \;:\; \underset{\text{sq. ft.}}{359{\cdot}975}, \text{ area of sector}$$

(10)...   Area of circular end $= 64^2 \times {\cdot}07958$

$$= 4096 \text{ sq. in.} \times {\cdot}07958$$

$$= 325{\cdot}95968 \text{ sq. in.}$$

Contents of roller $= 325{\cdot}95968 \text{ sq. in.} \times 78 \text{ in.}$

$$= 25424{\cdot}85504 \text{ cu. in.}$$

$$= 14 \text{ cu. ft. } 1232{\cdot}85504 \text{ cu. in.}$$

EXERCISE XXXVIII.

(1)...   16 acres, 30 perches $= 161{\cdot}875$ sq. chains

Breadth of field $= 161{\cdot}875$ sq. ch. $\div 17{\cdot}5$ ch. $= 9{\cdot}25$ chains

(2)...   Mean width of plank $= \tfrac{1}{2}(16\tfrac{1}{2} + 10\tfrac{1}{2}) = 13\tfrac{1}{2}$ in.

Area of plank $= 17\tfrac{1}{2}$ ft. $\times 1\tfrac{1}{8}$ ft. $= 19\tfrac{11}{16}$ sq. ft. $= 19$ sq. ft. 99 sq. in.

Value $19\tfrac{11}{16}$ sq. ft. at $8d.$ per ft. $= 13s.$ $1\tfrac{1}{8}d.$

	ft.	in.		ft.	in.
(3)...	13	8		16	0
	13	8		11	5
	177	8		176	0
	9	1 4		6	8
	186	9 4		182	8

	ft.	′	″
Area of square	186	9	4
do. of parall^{m}.	182	8	

The square is the larger by $\overline{4\,\text{ft.}\ 1'\ 4''}$ = 4 sq. ft. 16 sq. in.

(4)...　Area of floor = $55\frac{1}{2}$ ft. $\times 26\frac{1}{4}$ ft. = $1456\frac{7}{8}$ sq. ft.

Area of 1 yd. matting = 3 ft. $\times 2\frac{5}{8}$ ft. = $7\frac{7}{8}$ sq. ft.

Matting required $1456\frac{7}{8} \div 7\frac{7}{8}$ = 185 yds.

Cost, 185 yds. of matting, at 1s. 6d. per yd. = £13 17s. 6d.

(5)...　Area of circle = $55^2 \times \cdot07958$

= 3025 sq. in. $\times \cdot07958$

= $240\cdot7295$ sq. in.

Side of square = $\sqrt{240\cdot7295}$ = $15\cdot5154$ in.

(6)...　Base of triangle = (40 sq. yds. $\div 40$ ft.) $\times 2$

= (360 sq. ft. $\div 40$ ft.) $\times 2$

= 9 ft. $\times 2$ = 18 ft.

Each equal side = $\sqrt{40^2 + 9^2}$

= $\sqrt{1600 + 81}$

= $\sqrt{1681}$

= 41 ft.

(7)...

$$27$$
$$39$$
$$52$$
$$2\overline{)118}$$
$$59$$
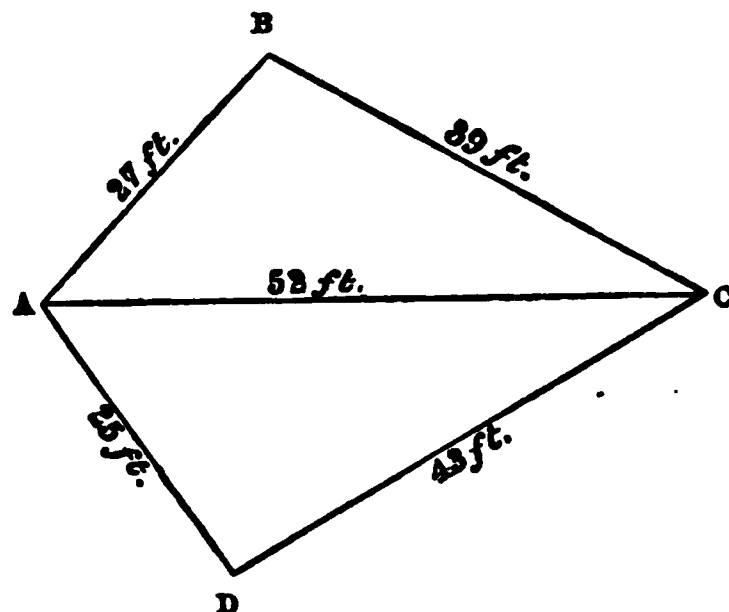
$$59-27 = 32$$
$$59-39 = 20$$
$$59-52 = 7$$

$$59 \times 32 \times 20 \times 7 = 264320$$

Area of triangle ABC $= \sqrt{264320} = 514{\cdot}1206$ sq. ft.

$$25$$
$$43$$
$$52$$
$$2\overline{)120}$$
$$60$$

$$60-25 = 35$$
$$60-43 = 17$$
$$60-52 = 8$$

$$60 \times 35 \times 17 \times 8 = 285600$$

Area of triangle ACD $= \sqrt{285600} = 534{\cdot}4155$ sq. ft.

$$514{\cdot}1206$$
$$534{\cdot}4155$$

Area of trapezium ABCDA $= \overline{1048{\cdot}5361}$ sq. ft.

(8)...   Area of semicircle $= \frac{1}{2}(65^2 \times 3{\cdot}1416)$
$$= \frac{1}{2}(4225 \text{ sq. ft.} \times 3{\cdot}1416)$$
$$= \frac{1}{2}(13273{\cdot}26 \text{ sq. ft.})$$
$$= 6636{\cdot}63 \text{ sq. ft.}$$
$$= 737 \text{ sq. yds. } 3{\cdot}63 \text{ sq. ft.}$$

(9)... Area of bottom of cistern

$$= 7 \text{ ft. } 9 \text{ in.} \times 3 \text{ ft. } 9 \text{ in.} = 93 \text{ in.} \times 45 \text{ in.} = 4185 \text{ sq. in.}$$

$$\text{Capacity} = 277\frac{1}{4} \text{ cu. in.} \times 540 = 149715 \text{ cu. in.}$$

$$\text{Depth} = 149715 \text{ cu. in.} \div 4185 \text{ sq. in,} = 35\frac{24}{31} \text{ in.}$$

(10)... See Appendix, page 180.

$$\text{Area of base of cone} = 33^2 \times \cdot 07958$$

$$= 1089 \text{ sq. ft.} \times \cdot 07958$$

$$= 86 \cdot 66262 \text{ sq. ft.}$$

$$\text{Solidity of cone} = \tfrac{1}{3}(86 \cdot 66262 \text{ sq. ft.} \times 35 \text{ ft.})$$

$$= \tfrac{1}{3}(3033 \cdot 1917 \text{ cu. ft.})$$

$$= 1011 \cdot 0639 \text{ cu. ft.}$$

EXERCISE XXXIX.

(1)...
$$42 \cdot 416^\circ = 42\tfrac{5}{12}^\circ = \quad 42^\circ \quad 25'$$
$$63 \cdot 83^\circ = 63\tfrac{5}{6}^\circ = \quad 63^\circ \quad 50'$$
$$\overline{\qquad\qquad 106^\circ \quad 15'}$$

$$180^\circ - 106^\circ \ 15' = 73^\circ \ 45'$$

(2)... $2725 \text{ links} \times 2725 \text{ links} = 7425625 \text{ sq. links}$

$$= 74 \text{ ac. } 1 \text{ ro. } 1 \text{ po.}$$

Value, 74 ac. 1 ro. 1 po. at £84 per acre = £6237 10s. 6d.

(3)...
$$\begin{array}{ccc} \text{ft.} & \text{ft.} & \text{ft.} \\ 29 \cdot 375 + 21 \cdot 3125 & = & 50 \cdot 6875 \end{array}$$
$$17 \cdot 6$$
$$\overline{3041250}$$
$$3548125$$
$$506875$$
$$2)\overline{892 \cdot 10000}$$

Area of trapezoid = $446 \cdot 05$ = $446\frac{1}{20}$ sq. ft.

(4)...

$$
\begin{array}{r}
23 \\
29 \\
44 \\
\hline
2)96 \\
\hline
48
\end{array}
\qquad
\begin{array}{l}
48-23 = 25 \\
48-29 = 19 \\
48-44 = 4
\end{array}
$$

$$48 \times 25 \times 19 \times 4 = 91200$$

Area of scalene triangle $= \sqrt{91200} = 301\cdot993$ sq. ft.

Side of equilateral triangle $= 32$ ft.　　$48-32 = 16$

$$48 \times 16 \times 16 \times 16 = 196608$$

Area of equilateral triangle $= \sqrt{196608} = 443\cdot405$ sq. ft.

$$
\begin{array}{r}
443\cdot405 \\
301\cdot993 \\
\hline
\end{array}
$$

The equilateral triangle is larger by $\overline{141\cdot412}$ sq. ft.

(5)...　Perimeter of room $= (18\tfrac{1}{4}+15\tfrac{1}{2}) \times 2 = 67\tfrac{1}{2} = 810$

　　(ft.　　ft.　　　　ft.　　in.)

Area of walls $= 810$ in. $\times 112$ in. $= 90720$ sq. in.

Area of each stamp $= \tfrac{7}{8}$ in. $\times \tfrac{3}{4}$ in. $= \tfrac{21}{32}$ of a sq. in.

No. of stamps required $= 90720 \div \tfrac{21}{32} = 138240$

(6)...　　Area of ring $= (33+28) \times (33-28) \times \cdot7854$

　　　　　　　(ft.　ft.　　ft.　ft.)

$ = 61$ ft. $\times 5$ ft. $\times \cdot7854$

$ = 305$ sq. ft. $\times \cdot7854$

$ = 239\cdot547$ sq. ft.

(7)...　Area of drawing-room floor $= 26\tfrac{1}{4}$ ft. $\times 23$ ft.

$ = 603\tfrac{3}{4}$ sq. ft.

Area of dining-room floor $= 31\tfrac{1}{2}$ ft. $\times 19\tfrac{1}{6}$ ft.

$ = 603\tfrac{3}{4}$ sq. ft.

Area of both floors, $1207\tfrac{1}{2}$ sq. ft.

Area of 1 yd. carpeting $= 3$ ft. $\times 1\tfrac{11}{12}$ ft. $= 5\tfrac{3}{4}$ sq. ft.

Carpeting required, $1207\tfrac{1}{2} \div 5\tfrac{3}{4} = 210$ yds.

Cost, 210 yds. carpeting, at 4s. 11d. per yd. $= £51$ 12s. 6d.

(8)... $\quad$ AC = 61 in. $\qquad$ BC = 11 in.

$$AB = \sqrt{AC^2 - BC^2}$$
$$= \sqrt{61^2 - 11^2}$$
$$= \sqrt{3721 - 121}$$
$$= \sqrt{3600}$$
$$= 60 \text{ in.} = 5 \text{ ft.}$$
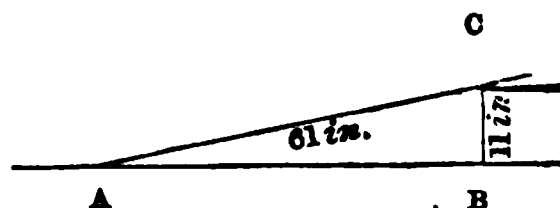
(9)... $\qquad$ Mean depth $= \frac{1}{2}(6\frac{1}{2} + 2\frac{1}{2}) = 4\frac{1}{2}$ ft.

40 yds. × 12 yds. × $4\frac{1}{2}$ ft. = 1440 in. × 432 in. × 54 in.

$$= 33592320 \text{ cu. in.}$$

33592320 ÷ 277·274 = 121152·0734 gallons

(10)...
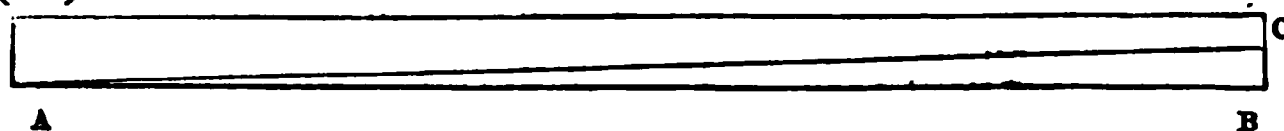
AB = 40 yds. = 120 ft. $\quad$ BC = $6\frac{1}{2}$ ft. − $2\frac{1}{2}$ ft. = 4 ft.

Length of sloping bottom $= \sqrt{120^2 + 4^2}$

$$= \sqrt{14400 + 16}$$
$$= \sqrt{14416}$$
$$= 120·066 \text{ ft.}$$

Area of bottom = 120·066 ft. × 36 ft. = 4322·376 sq. ft.

$$= 480·264 \text{ sq. yds.}$$

$480\frac{1}{4}$ sq. yds. at 3s. per yd. = £72 0s. 9d.

EXERCISE XL.

(1)...
Altitude of triangle = (104 sq. ft. 4 sq. in. ÷ 17 ft. 10 in.) × 2
$$= (14980 \text{ sq. in.} ÷ 214 \text{ in.}) × 2$$
$$= 70 \text{ in.} × 2$$
$$= 140 \text{ in.} = 11 \text{ ft. 8 in.}$$

(2)...Perpendicular height of triangle

$$= \sqrt{106^2 - 56^2}$$
$$= \sqrt{11236 - 3136}$$
$$= \sqrt{8100}$$
$$= 90 \text{ yds.}$$

Area of triangle $= \frac{1}{2}(56 \text{ yds.} \times 90 \text{ yds.})$
$$= \frac{1}{2}(5040 \text{ sq. yds.})$$
$$= 2520 \text{ sq. yds.}$$

(3)... 5 ac. 2 ro. 36 per. 26 sq. yds. $= 27735$ sq. yds.

Let $5x =$ length of field, in yards
and $3x =$ breadth of ,, ,,

Then, area $= 15x^2 = 27735$
$$x^2 = 1849$$
$$x = 43$$

Hence, Length of field $= 5x = 215$ yds.
Breadth of ,, $= 3x = 129$ yds.

(4)... 6 ac. 3 ro. 3 per. $7\frac{1}{4}$ sq. yds. $= 32768$ sq. yds.

Length of diagonal path $= \sqrt{32768 \times 2}$
$$= \sqrt{65536}$$
$$= 256 \text{ yds}$$

(5)...Area of floor

$$= (19\frac{2}{3} \text{ ft.} \times 16\frac{1}{2} \text{ ft.}) + (5\frac{1}{3} \text{ ft.} \times 1\frac{1}{2} \text{ ft.} \times 2)$$
$$= 324\frac{1}{2} \text{ sq. ft.} + 16 \text{ sq. ft.}$$
$$= 340\frac{1}{2} \text{ sq. ft.}$$
$$= 37\frac{5}{6} \text{ sq. yds}$$

(6)...Area of parallelogram ABCD

$$= 35 \text{ ft.} \times 12 \text{ ft.} = 420 \text{ sq. ft.}$$

Area of semicircular top

$$= \tfrac{1}{2}(12^2 \times \cdot 7854)$$
$$= \tfrac{1}{2}(144 \text{ sq. ft.} \times \cdot 7854)$$
$$= \tfrac{1}{2}(113 \cdot 0976 \text{ sq. ft.})$$
$$= 56 \cdot 5488 \text{ sq. ft.}$$
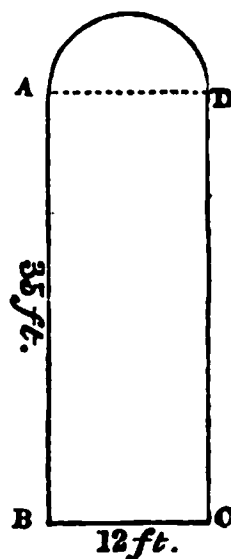
$$\begin{array}{r} 420 \\ 56 \cdot 5488 \\ \hline \end{array}$$

Area of window $= \overline{476 \cdot 5488}$ sq. ft.

(7)...   Circumference of circle $= 27 \cdot 875 \text{ ft.} \times 2 \times 3 \cdot 1416$

$$= 175 \cdot 1442 \text{ ft.}$$

			ft.		ft.
360°	:	43° 52′ 30″	:: 175·1442	:	21·345699375

(8)...

	ft. in.		ft. in.
	$(2 \quad 10\tfrac{1}{2})^3$	:	$(3 \quad 10)^3$
	$(34\tfrac{1}{2})^3$	:	$(46)^3$
	3^3	:	4^3
	27	:	64

(9)...

lb.		lb.		cu. ft.		cu. ft.
$168\tfrac{3}{4}$	:	560	::	1	:	$3\tfrac{43}{135}$

Contents of block $= 3\tfrac{43}{135}$ cu. ft. $= 3$ cu. ft. $550\tfrac{2}{3}$ cu. in.

(10)... 1 cu. ft. of gunpowder weighs 932 oz. $= 58\tfrac{1}{4}$ lb.

Capacity of box, $2\tfrac{2}{3}$ ft. $\times 1\tfrac{1}{2}$ ft. $\times 1\tfrac{9}{24}$ ft. $= 5\tfrac{1}{2}$ cu. ft.

Weight of gunpowder, $58\tfrac{1}{4}$ lb. $\times 5\tfrac{1}{2} = 320\tfrac{3}{8}$ lb.

EXERCISE XLI.

(1)...Area of parallelogram, 980 sq. ft. 28 sq. in.=141148 sq. in.

Let $7x$ = the length, in inches

and $4x$ = the breadth   „

Then, area = $28x^2$ = 141148

$$x^2 = 5041$$

$$x = 71$$

Hence, the length = 71×7 = 497 in. = 41 ft. 5 in.

the breadth = 71×4 = 284 in. = 23 ft. 8 in.

(2)...   Let $20x$ = the base of the triangle, in feet

and $21x$ = the perpendicular „   „

Then, area = $\frac{1}{2}(20x \times 21x)$ = $210x^2$

$210x^2 = 583\frac{1}{3}$ sq. yds. = 5250 sq. ft.

$$x^2 = 25$$

and $x = 5$

Hence, Base of triangle = 5×20 = 100 ft.

Perpendicular   = 5×21 = 105 ft.

Hypotenuse   = $\sqrt{100^2 + 105^2}$

= $\sqrt{10000 + 11025}$

= $\sqrt{21025}$

= 145 ft.

(3)...   165 square miles = 105600 acres

$$\frac{15000}{105600} + \frac{800}{800} = \frac{25}{176}$$

(4)...Side of required square

$$= \sqrt{18^2 + (22\frac{1}{2})^2 + 24^2}$$

$$= \sqrt{324 + 506 \cdot 25 + 576}$$

$$= \sqrt{1406 \cdot 25}$$

$$= 37 \cdot 5 = 37\frac{1}{2} \text{ yds.}$$

(5)...Perimeter of room $= (27\frac{1}{2} \text{ ft.} + 20\frac{1}{6} \text{ ft.}) \times 2 = 95\frac{1}{3} \text{ ft.}$

Area of walls $= 95\frac{1}{3} \text{ ft.} \times 11 \text{ ft.} = 1048\frac{2}{3} \text{ sq. ft.}$

Area of 1 piece of paper $= 3 \text{ ft.} \times 1\frac{5}{6} \text{ ft.} \times 12 = 66 \text{ sq. ft.}$

Paper required, $1048\frac{2}{3} \div 66 = 15\frac{8}{9} \text{ pieces}$

(6)...Circumference of circle $= 85 \text{ ft.} \times 2 \times 3 \cdot 1416 = 534 \cdot 072 \text{ ft.}$

$$= 178\frac{3}{125} \text{ yds.}$$

Cost of fencing, $178\frac{3}{125}$ yds. at $15d$. per yd. $= £11 \ 2s. \ 6\frac{9}{25}d.$

(7)...   Area of circle $= 10^2 \times 3 \cdot 1416$

$$= 100 \text{ sq. in.} \times 3 \cdot 1416$$

$$= 314 \cdot 16 \text{ sq. in.}$$

			sq. in.		sq. in.	
360°	:	51° 45′	::	314·16	:	45·1605, area of sector

(8)...1 cubic foot of the marble weighs 2700 oz. $= 168\frac{3}{4} \text{ lb.}$

Contents of block, $4\frac{5}{6} \text{ ft.} \times 1\frac{5}{6} \text{ ft.} \times 1\frac{1}{4} \text{ ft.} = 11\frac{11}{144} \text{ cu. ft.}$

Weight of block $= 168\frac{3}{4} \text{ lb.} \times 11\frac{11}{144} = 1869\frac{9}{64} \text{ lb.}$

$$= 16 \text{ cwt. } 2 \text{ qrs. } 21\frac{9}{64} \text{ lb.}$$

(9)...   Contents of stack $= 10\frac{2}{3}$ yds. $\times 7\frac{1}{3}$ yds. $\times 7\frac{1}{3}$ ft.

$$= 384 \text{ in.} \times 264 \text{ in.} \times 88 \text{ in.}$$

$$= 8921088 \text{ cu. in.}$$

Contents of each stone, 8921088 cu. in. $\div 14724 = 512$ cu. in.

$\sqrt[3]{512} = 8$, $\therefore$ each stone is a cube of 8 inches

(10)...   Area of mouth of well $= (4\frac{1}{4})^2 \overset{\text{ft.}}{} \times \cdot 7854$

$$= 18 \cdot 0625 \text{ sq. ft.} \times \cdot 7854$$

$$= 14 \cdot 1862875 \text{ sq. ft.}$$

14·1862875 sq. ft. $\times 330$ ft. $= 4681 \cdot 474875$ cu. ft.

EXERCISE XLII.

(1)...   Area of parallelogram $= 250$ yds. $\times 55 \cdot 225$ yds.

$$= 13806 \cdot 25 \text{ sq. yds.}$$

Side of square $= \sqrt{13806 \cdot 25} = 117 \cdot 5$ yds. $= 117\frac{1}{2}$ yds.

(2)...   Area of field $= \frac{1}{2}(1045 \overset{\text{li.}}{} + 1275 \overset{\text{li.}}{}) \times 775 \overset{\text{li.}}{}$

$$= \frac{1}{2}(2320 \text{ li.} \times 775 \text{ li.})$$

$$= \frac{1}{2}(1798000 \text{ sq. li.})$$

$$= 899000 \text{ sq. li.}$$

$$= 8 \text{ ac. } 3 \text{ ro. } 38 \cdot 4 \text{ po.}$$

(3)...   20000 acres $= 96800000$ sq. yds.

23 miles $= 40480$ yds.

Average breadth $= 96800000$ sq. yds. $\div 40480$ yds.

$$= 2391\frac{7}{23} \text{ yds.}$$

(4)...   Let $8x$ = the base of the triangle, in inches

and $15x$ = the perpendicular of ,,   ,,

Then, the hypotenuse = $\sqrt{(8x)^2 + (15x)^2}$

$$= \sqrt{64x^2 + 225x^2}$$

$$= \sqrt{289x^2}$$

$$= 17x$$

Now, $17x$ = 19 ft. 10 in. = 238 in.

$$\therefore x = 14$$

Hence, the base of the triangle = 14 in. $\times$ 8 = 9 ft. 4 in.

And the perpendicular   ,,   = 14 in. $\times$ 15 = 17 ft. 6 in.

```
        ft.  in.
        17    6
         9    4
       ───────────
       157    6
         5   10
       2)163   4
       ───────────
        81    8
```
Area of triangle =   81 8 = 81 sq. ft. 96 sq. in.

(5)...   Perimeter of room = $(28 + 22\frac{1}{2}) \times 2$ = 101 ft.

Area of walls = 101 ft. $\times$ 10 ft. = 1010 sq. ft.

Area of ceiling = 28 ft. $\times$ $22\frac{1}{2}$ ft. = 630 sq. ft.

Area of two windows = 7 ft. $\times$ 4 ft. $\times$ 2 ft. = 56 sq. ft.

Area of door = $7\frac{1}{2}$ ft. $\times$ $4\frac{1}{6}$ ft. = $31\frac{1}{4}$ sq. ft.

Area of fireplace = 5 ft. $\times$ 5 ft. = 25 sq. ft.

1010 sq. ft. + 630 sq. ft. = 1640 sq. ft.

56 sq. ft. + $31\frac{1}{4}$ sq. ft. + 25 sq. ft. = $112\frac{1}{4}$ sq. ft.

Area of painting = $1527\frac{3}{4}$ sq. ft. = $169\frac{3}{4}$ sq. yds.

Cost, $169\frac{3}{4}$ sq. yds. at $8d$. per sq. yd. = £5 13s. 2d.

(6)... Area of floor = 630 sq. ft.

Area of 1 yd. of carpeting = 3 ft. × 2¼ ft. = 6¾ sq. ft.

Carpeting required, 630÷6¾ = 93⅓ yds.

Cost, 93⅓ yds. of carpeting, at 4s. 3d. per yd. = £19 16s. 8d.

(7)...Contents of block = $\overset{in.}{64} \times \overset{in.}{44} \times \overset{in.}{30\frac{1}{4}}$ = 85184 cu. in.

The edge of a cube of equal volume

$= \sqrt[3]{85184}$ = 44 in. = 3 ft. 8 in.

(8)... 37½ mi. = 66000 yds.

Mean width of canal = ½(18+16) = 17 yds.

66000 yds. × 17 yds. × 2⅓ yds. = 2618000 cu. yds.

Cost of excavating, 2618000 cu. yds. at 7½d. per cu. yd.

= £81812 10s.

(9)... Radius of flower-bed = $\sqrt{(45 \times 2) \div 3\cdot1416}$

$= \sqrt{28\cdot647822}$

= 5·352 ft.

(10)...

```
    8
    3
  2)24
    12
```

12−8 = 4

12×4×4×4 = 768

Area of base = $\sqrt{768}$ = 27·7128 sq. ft.

Solidity of pyramid = ⅓(27·7128 sq. ft. × 13½ ft.)

= ⅓(374·1228 cu. ft.)

= 124·7076 cu. ft.

EXERCISE XLIII.

(1)...   £1124 11s.+2s. 10d. = 269892d.÷34d.

= 7938, No. sq. yds.

Let x = the breadth of the ground, in yds.

and $2x$ = the length ,,   ,,   ,,

The area = $2x^2$ = 7938

x^2 = 3969

x = 63

Hence, the breadth = 63 yds. and the length = 126 yds.

(2)...

$$11 \ : \ 14 \ :: \ 137\tfrac{5}{33} \overset{\text{Ir. mi.}}{} \ : \ \overset{\text{Eng. mi.}}{x}$$

$$x = \frac{1}{\cancel{11}} \times \frac{\overset{7}{\cancel{14}}}{1} \times \frac{\overset{399}{\cancel{4389}}}{\underset{16}{\cancel{32}}} = \frac{2793}{16} \text{ mi.} = 174 \text{ mi. } 4 \text{ fur. } 110 \text{ yds.}$$

(3)...   Circumference of circle = 15·125 ft. × 2 × 3·1416

= 95·0334 ft.

$$360° \ : \ 28° \ 7' \ 30'' \ :: \ \overset{\text{ft.}}{95\cdot0334} \ : \ \overset{\text{ft.}}{7\cdot424484375}$$

(4)...   OA = $4\tfrac{1}{4}$ mi. × 6 = $25\tfrac{1}{2}$ mi.

OB = 36 mi. × 6 = 216 mi.

$$AB = \sqrt{(25\tfrac{1}{2})^2 + 216^2}$$

$$= \sqrt{650\cdot25 + 46656}$$

$$= \sqrt{47306\cdot25}$$

$$= 217\cdot5 \text{ mi.} = 217\tfrac{1}{2} \text{ mi.}$$
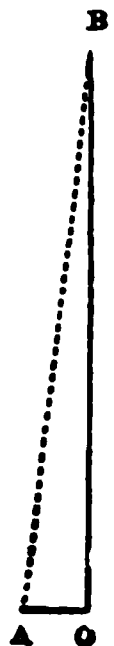
(5)...   Area of circle $= (17\frac{3}{4}$ ft.$)^2 \times 3 \cdot 1416$

$= 315 \cdot 0625$ sq. ft. $\times 3 \cdot 1416$

$= 989 \cdot 80035$

sq. ft.   sq. ft.
$360° : 50° 24' :: 989 \cdot 80035 : 138 \cdot 572049$, area of sector

(6)...   1 cu. ft. of ivory weighs 1825 oz.

$(1\frac{3}{4})^3 = (\frac{7}{4})^3 = \frac{343}{64} = 5\frac{23}{64} = 5 \cdot 359375$ cu. in.

cu. in.   cu. in.   oz.   oz.
1728   : $5 \cdot 359375$ ::   1825   : $5 \cdot 6602195$

(7)...Dimensions on the outer side of the ditch,

Length, 225 yds. $+ (4\frac{1}{2}$ ft. $\times 2) = 228$ yds.

Breadth, 185 yds. $+ (4\frac{1}{2}$ ft. $\times 2) = 188$ yds.

yds.   yds.   yds.   yds.
Surface of ditch $= (228 \times 188) - (225 \times 185)$

$= 42864$ sq. yds. $- 41625$ sq. yds.

$= 1239$ sq. yds.

Earth taken out, 1239 sq. yds. $\times \frac{3}{4}$ yd. $= 929\frac{1}{4}$ cu. yds.

(8)... $929\frac{1}{4}$ cu. yds. $= 43355088$ cu. in.

Surface of field $= 41625$ sq. yds. $= 53946000$ sq. in.

43355088 cu. in. $\div 53946000 = \cdot 80367$ of an inch

(9)...See Appendix, page 180

Surface of globe $= (1$ yd.$)^2 \times 3 \cdot 1416$

$= 3 \cdot 1416$ sq. yds.

sq. yd.   sq. yds.   s. d.   s. d.
1   : $3 \cdot 1416$ ::   1   6   :   4 $8\frac{1}{2}$

(10)...Capacity of punch-bowl

$$= \tfrac{1}{2}(15^3 \times \cdot 5236)$$

$$= \tfrac{1}{2}(3375 \text{ cu. in.} \times \cdot 5236)$$

$$= \tfrac{1}{2}(1767 \cdot 15 \text{ cu. in.})$$

$$= 883 \cdot 575 \text{ cu. in.}$$

$$= 3 \cdot 186 \text{ gal.}$$

EXERCISE XLIV.

(1)...   Area of field $= \tfrac{1}{2}(1760 \text{ li.} \times 2450 \text{ li.})$

$$= \tfrac{1}{2}(4287500 \text{ sq. li.})$$

$$= 2143750 \text{ sq. li.}$$

$$= 21 \text{ ac. } 1 \text{ ro. } 30 \text{ per.}$$

(2)...   2 cu. ft. 1457 cu. in. $= 4913$ cu. in.

Edge of cube $= \sqrt[3]{4913} = 17$ in. $= 1$ ft. 5 in.

```
              ft.  in.
               1   5
               1   5
              ───────
               1   5
                   7  1
Surface of each side =  2  0  1
                           6
Whole surface = 12  0  6 = 12 sq. ft. 6 sq. in.
```

(3)...12 angles of dodecagon + 4 rt. angles $=$ 24 rt. angles

12 angles of dodecagon $=$ 20 rt. angles

Each angle of dodecagon $= \tfrac{5}{3}$ of a rt. angle

$$= \tfrac{5}{3} \text{ of } 90°$$

$$= 150°$$

(4)... $3\frac{3}{4}$ ac. $=$ 18150 sq. yds.

Diameter of field $= \sqrt{18150 \div \cdot 7854}$

$= \sqrt{23109 \cdot 243697}$

$= 152 \cdot 017$ yds.

(5)... $(7\frac{1}{2})^2$ $:$ $(8\frac{3}{4})^2$ $:$ $(11\frac{1}{4})^2$

6^2 $:$ 7^2 $:$ 9^2

36 $:$ 49 $:$ 81

(6)...   Area of ellipse $=$ 25 in. $\times$ 18 in. $\times \cdot 7854$

$=$ 450 sq. in. $\times \cdot 7854$

$=$ 353·43 sq. in.

$=$ 2 sq. ft. 65·43 sq. in.

(7)...Contents of block $= 6\frac{2}{3}$ ft. $\times 1\frac{1}{2}$ ft. $\times 1\frac{1}{2}$ ft. $=$ 15 cu. ft.

Weight of block $= 169\frac{3}{4}$ lb. $\times$ 15

$= 2546\frac{1}{4}$ lb.

$=$ 1 ton 2 cwt. 2 qrs. $26\frac{1}{4}$ lb.

(8)...Capacity of tank, 277·274 cu. in. $\times$ 1000 $=$ 277274 cu. in.

$45\frac{15}{16}$ sq. ft. $=$ 6615 sq. in.

Depth of tank $=$ 277274 cu. in. $\div$ 6615 sq. in.

$=$ 41·915 in.

$=$ 3 ft. 5·915 in.

(9)... Inside dimensions of chest:—length, 5 ft. 1 in., breadth, 2 ft., depth, 1 ft. 10 in.

Wood in chest = $(\overset{ft.}{5\frac{1}{4}} \times \overset{ft.}{2\frac{1}{6}} \times \overset{ft.}{2}) - (\overset{ft.}{5\frac{1}{12}} \times \overset{ft.}{2} \times \overset{ft.}{1\frac{5}{6}})$

$= 22\frac{3}{4}$ cu. ft. $- 18\frac{23}{36}$ cu. ft. $= 4\frac{1}{9}$ cu. ft.

1 cu. ft. of oak weighs 925 oz.

Weight of oak $= 925$ oz. $\times 4\frac{1}{9} = 3802\frac{7}{9}$ oz.

$= 2$ cwt. 13 lb. 10 $\frac{7}{9}$ oz.

(10)... $\overset{in.}{42} \times \overset{in.}{(1\frac{1}{2})^2}$: $\overset{in.}{70} \times \overset{in.}{(2\frac{5}{8})^2}$ :: $\overset{lb.}{21\frac{1}{2}}$: x

$x = \{70 \times (2\frac{5}{8})^2 \times 21\frac{1}{2}\} \div \{42 \times (1\frac{1}{2})^2\}$

$= \frac{\overset{}{7\cancel{0}}}{1} \times \frac{\overset{35}{\cancel{21}}}{\underset{4}{\cancel{8}}} \times \frac{\overset{7}{\cancel{21}}}{8} \times \frac{43}{\cancel{2}} \times \frac{1}{\underset{\cancel{2}}{\cancel{42}}} \times \frac{\cancel{2}}{\cancel{3}} \times \frac{\cancel{2}}{3}$

$= \frac{10535}{96}$ lb. $= 109\frac{71}{96}$ lb. $= 109$ lb. $11\frac{5}{6}$ oz.

EXERCISE XLV.

(1)... Side of triangle = 140 yds.

$2)\overline{420}$
210 $210 - 140 = 70$

$210 \times 70 \times 70 \times 70 = 72030000$

Area of triangle = $\sqrt{72030000} = 8487\cdot0489$ sq. yds.

(2)... Area of circle = $\overset{ft.}{(17\frac{1}{2})^2} \times 3\cdot1416$

$= 306\cdot25$ sq. ft. $\times 3\cdot1416$

$= 962\cdot115$ sq. ft.

$360°$: $25°$ :: $\overset{sq. ft.}{962\cdot115}$: $\overset{sq. ft.}{66\cdot8135416}$, area of sector

(3)...   60 cu. ft. 143 cu. in. = 103823 cu. in.

Edge of cube = $\sqrt[3]{103823}$ = 47 in. = 3 ft. 11 in.

$$
\begin{array}{rr}
\text{ft.} & \text{in.} \\
3 & 11 \\
3 & 11 \\
\hline
11 & 9 \\
3 \quad 7 & 1 \\
\end{array}
$$

Surface of each side = 15 4 1
                            6

Whole surface = $\overline{92 \quad 0 \quad 6}$ = 92 sq. ft. 6 sq. in.

(4)... 165 yds. × 82½ yds. = 13612½ sq. yds. = $2\frac{13}{16}$ ac.

Value of field, £64 × $2\frac{13}{16}$ = £180

Perimeter of field = $(\overset{\text{yds.}}{165} + \overset{\text{yds.}}{82\frac{1}{2}}) \times 2$ = 495 yds. = 90 ro.

Cost of fencing = 8s. 9d. × 90 = £39 7s. 6d.

(5)... Area of walk = $(\overset{\text{ft.}}{235} + \overset{\text{ft.}}{225}) \times (\overset{\text{ft.}}{235} - \overset{\text{ft.}}{225}) \times \cdot 7854$

= 460 ft. × 10 ft. × ·7854

= 4600 sq. ft. × ·7854

= 3612·84 sq. ft.

= 401·426 sq. yds.

(6)...   Diameter of circle = $\sqrt{1 \div \cdot 7854}$

= $\sqrt{1 \cdot 2732365673}$

= 1·12837 ft.

(7)...Area of each end of cylinder

$$= (5 \cdot 25)^2 \times \cdot 07958$$

$$= 27 \cdot 5625 \text{ sq. ft.} \times \cdot 07958$$

$$= 2 \cdot 19342375 \text{ sq. ft.}$$

Whole surface of cylinder

$$= (5 \cdot 25 \text{ ft.} \times 15 \text{ ft.}) + (2 \cdot 19342375 \text{ sq. ft.} \times 2)$$

$$= 78 \cdot 75 \text{ sq. ft.} + 4 \cdot 3868475 \text{ sq. ft.}$$

$$= 83 \cdot 1368475 \text{ sq. ft.}$$

(8)...

$$\begin{array}{llll}
& & & \text{sq. ft.} \\
\text{Area of bottom of tank} & = 8\frac{1}{4} \text{ ft.} \times 3\frac{3}{4} \text{ ft.} & = & 30\frac{15}{16} \\
\text{Area of two sides} & = 8\frac{1}{4} \text{ ft.} \times 3\frac{1}{2} \text{ ft.} \times 2 \ldots & = & 57\frac{3}{4} \\
\text{Area of two ends} & = 3\frac{3}{4} \text{ ft.} \times 3\frac{1}{2} \text{ ft.} \times 2 \ldots & = & \underline{26\frac{1}{4}} \\
& & & 114\frac{15}{16}
\end{array}$$

Weight of the lead $= 7 \text{ lb.} \times 114\frac{15}{16} = 804\frac{9}{16}$ lb.

$$= 7 \text{ cwt. } 20 \text{ lb. } 9 \text{ oz.}$$

Cost, 7 cwt. 20 lb. 9 oz. at 24s. 6d. per cwt. $= £8 \text{ } 15s. \text{ } 11\frac{125}{128}d.$

(9)... 1 cubic foot of iron weighs 7250 ounces

$$\begin{array}{cccccccc}
\text{oz.} & & \text{lbs.} & \text{oz.} & & \text{cu. in.} & & \text{cu. in.} \\
7250 & : & 15 = 240 & & :: & 1728 & : & 57\frac{147}{725}
\end{array}$$

Length of rod $= 57\frac{147}{725}$ in. $= 4$ ft. $9\frac{147}{725}$ in.

(10)...

$$\begin{array}{c}
\text{ft.} \\
\text{Area of base} = (3\frac{1}{2})^2 \times \cdot 7854
\end{array}$$

$$= 12\frac{1}{4} \text{ sq. ft.} \times \cdot 7854$$

$$= 9 \cdot 62115 \text{ sq. ft.}$$

Solidity of cone $= \frac{1}{3}(9 \cdot 62115 \text{ sq. ft.} \times 10\frac{1}{2} \text{ ft.})$

$$= \frac{1}{3}(101 \cdot 022075 \text{ cu. ft.})$$

$$= 33 \cdot 674025 \text{ cu. ft.}$$

EXERCISE XLVI.

(1)...Mean width of each plank $= \frac{1}{2}(\overset{\text{in.}}{15} + \overset{\text{in.}}{10}) = 12\frac{1}{2}$ in.

Area of 16 planks $= 13\frac{3}{4}$ ft. $\times 1\frac{1}{24}$ ft. $\times 16 = 229\frac{1}{6}$ sq. ft.

Value, $229\frac{1}{6}$ sq. ft. at $7\frac{1}{2}d.$ per ft. $= £7$ 3s. $2\frac{3}{4}d.$

(2)... $229\frac{1}{6}$ sq. ft. $\times \frac{1}{12}$ ft. $= 19\frac{7}{72}$ cu. ft.

1 cubic foot of fir weighs 550 ounces

Weight of planks $= 550$ oz. $\times 19\frac{7}{72} = 10503\frac{17}{36}$ oz.

$= 5$ cwt. 3 qrs. 12 lb. $7\frac{17}{36}$ oz.

(3)... 19 ft. $5\frac{1}{4}$ in. $= 19\cdot4375$ ft.

Base of triangle $= (173\cdot72265625$ sq. ft. $\div 19\cdot4375$ ft.$) \times 2$

$= 8\cdot9375$ ft. $\times 2$

$= 17\cdot875$ ft. $= 17$ ft. $10\frac{1}{2}$ in.

(4)...Area of foundation $= (\overset{\text{ft.}}{25} + \overset{\text{ft.}}{21}) \times (\overset{\text{ft.}}{25} - \overset{\text{ft.}}{21}) \times \cdot7854$

$= 46$ ft. $\times 4$ ft. $\times \cdot7854$

$= 184$ sq. ft. $\times \cdot7854$

$= 144\cdot5136$ sq. ft.

(5)... $2\frac{1}{2}$ acres $= 12100$ sq. yds.

Side of square plot $= \sqrt{12100} = 110$ yds.

110 yds. $+ (12\frac{1}{2}$ yds. $\times 2) = 135$ yds.

Area of moat $= 135^2 - 110^2 = 18225 - 12100$

$= 6125$ sq. yds.

(6)...   Capacity of moat = 6125 sq. yds. × 2½ yds.

$$= 15312\tfrac{1}{2} \text{ cu. yds.}$$

$$= 714420000 \text{ cu. in.}$$

714420000 ÷ 277·274 = 2576584·894 gallons

(7)... $(10\tfrac{1}{2})^3 \times 4 = 1157\tfrac{5}{8}$ cu. in. × 4 = 4630½ cu. in.

Height of required cube = $\sqrt[3]{4630\cdot5}$ = 16·667 in.

(8)... 1 cubic foot of the stone weighs 2496 oz. = 156 lb.

Area of circular end = $15^2 \times \cdot7854$

$$= 225 \text{ sq. in.} \times \cdot7854$$

$$= 176\cdot715 \text{ sq. in.}$$

Solidity of roller = 176·715 sq. in. × 48 in. = 8482·32 cu. in.

$$= 4\cdot90875 \text{ cu. ft.}$$

Weight of roller = 156 lb. × 4·90875 = 765·765 lb.

$$= 765 \text{ lb. } 12\tfrac{6}{25} \text{ oz.}$$

(9)...Diameter of inside of roller = 15 in. − ($\tfrac{3}{4}$ in. × 2) = 13½ in.

Area of section of roller = (15 + 13½) × (15 − 13½) × ·7854

$$= 28\tfrac{1}{2} \text{ in.} \times 1\tfrac{1}{2} \text{ in.} \times \cdot7854$$

$$= 42\tfrac{3}{4} \text{ sq. in.} \times \cdot7854$$

$$= 33\cdot57585 \text{ sq. in.}$$

33·57585 sq. in. × 48 in. = 1611·6408 cu. in.

1 cubic foot of iron weighs 7248 oz. = 453 lb.

cu. in.		cu. in.		lb.		lb.
1728	:	1611·6408	::	453	:	422·4961125

Weight of iron roller = 422·4961125 lb. = 422 lb. 7·9378 oz.

(10)... Area of base $= 8^2 \times \cdot 07958$

$\qquad = 64$ sq. ft. $\times \cdot 07958$

$\qquad = 5\cdot 09312$ sq. ft.

Solidity of cone $= \frac{1}{3}(5\cdot 09312$ sq. ft. $\times 9\cdot 75$ ft.$)$

$\qquad = \frac{1}{3}(49\cdot 65792$ cu. ft.$)$

$\qquad = 16\cdot 55264$ cu. ft.

EXERCISE XLVII.

(1)... Area of front $= 50$ ft. $\times 28$ ft. $= 1400$ sq. ft.

8 windows, each 6 ft. $\times 3\frac{1}{2}$ ft. $= 168$ sq. ft.
3 ditto $\quad$ each 4 ft. $\times 3\frac{1}{2}$ ft. $= \quad 42$ „
$\qquad$ door 8 ft. $\times 4\frac{3}{4}$ ft. $= \quad \underline{38}$ „
$\qquad\qquad\qquad\qquad\qquad\qquad\quad \overline{248}$ „

Area coloured 1400 sq. ft. -248 sq. ft. $= 1152$ sq. ft.

$\qquad\qquad\qquad\qquad\qquad\qquad = 128$ sq. yds.

Cost of colouring, 128 sq. yds. at $3d.$ per yd. $= £1$ $12s.$

(2)... Let $9x =$ the base of the triangle, in feet,

and $19\frac{1}{4}x =$ the perpendicular of the triangle, in feet

Now, $(9x)^2 + (19\frac{1}{4}x)^2 = 170^2$

$\qquad 81x^2 + 370\cdot 5625x^2 = 28900$

$\qquad\qquad 451\cdot 5625x^2 = 28900$

$\qquad\qquad\qquad x^2 = 64$

$\qquad\qquad\qquad x = 8$

Hence, the base of the triangle $= 8 \times 9 = 72$ ft.

$\qquad$ the perpendicular $\quad = 8 \times 19\frac{1}{4} = 154$ ft.

Area of triangle $= \frac{1}{2}(72$ ft. $\times 154$ ft.$)$

$\qquad\qquad\qquad = \frac{1}{2}(11088$ sq. ft.$)$

$\qquad\qquad\qquad = 5544$ sq. ft.

$\qquad\qquad\qquad = 616$ sq. yds.

(3)...

$$
\begin{array}{r}
845 \\
1025 \\
1350 \\
\hline
2\overline{)3220} \\
\hline
1610
\end{array}
\qquad
\begin{array}{l}
1610 - 845 = 765 \\
1610 - 1025 = 585 \\
1610 - 1350 = 260
\end{array}
$$

$$1610 \times 765 \times 585 \times 260 = 187333970000$$

Area of field $= \sqrt{187333970000} = 432815$ sq. links

$$= 4 \text{ ac. } 1 \text{ ro. } 12\cdot5 \text{ po.}$$

(4)...See Appendix, page 179, and Euclid, Book III. Prop. 22.

$$
\begin{array}{r}
10 \\
17 \\
23 \\
16 \\
\hline
2\overline{)66} \\
\hline
33
\end{array}
\qquad
\begin{array}{l}
33 - 10 = 23 \\
33 - 17 = 16 \\
33 - 23 = 10 \\
33 - 16 = 17
\end{array}
$$

$$23 \times 16 \times 10 \times 17 = 62560$$

Area of figure $= \sqrt{62560} = 250\cdot119$ sq. ft.

(5)... Let $x =$ the side of the given square, in feet

Then $x + 5 =$ the side of the enlarged square, in feet

$$\text{Now, } (x+5)^2 - x^2 = 295$$

$$i.e. \quad x^2 + 10x + 25 - x^2 = 295$$

$$\therefore 10x = 270$$

$$\text{and } x = 27$$

$\therefore$ the side of the original square $= 27$ ft.

(6)...   Radius of quadrant $= \sqrt{(490\cdot875 \times 4) \div 3\cdot1416}$

$$= \sqrt{1963\cdot5 \div 3\cdot1416}$$

$$= \sqrt{625}$$

$$= 25 \text{ yds.}$$

a b

c e

d f
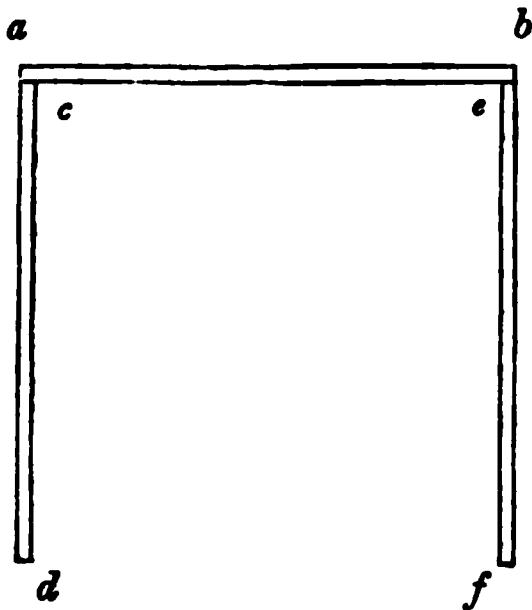
(7)...Side of court $= \sqrt{2756 \cdot 25}$

$$= 52 \cdot 5 = 52\tfrac{1}{2} \text{ ft.}$$

$$ab = 52\tfrac{1}{2} \text{ ft.} + (1\tfrac{7}{8} \text{ ft.} \times 2)$$
$$= 52\tfrac{1}{2} \text{ ft.} + 3\tfrac{3}{4} \text{ ft.}$$
$$= 56\tfrac{1}{4} \text{ ft.}$$

Length of wall $= ab + cd + ef$

$$= 56\tfrac{1}{4} \text{ ft.} + 52\tfrac{1}{2} \text{ ft.} + 52\tfrac{1}{2} \text{ ft.}$$

$$= 161\tfrac{1}{4} \text{ ft.}$$

Solidity of wall $= 161\tfrac{1}{4}$ ft. $\times 9\tfrac{1}{2}$ ft. $\times 1\tfrac{7}{8}$ ft.

$$= 2872\tfrac{17}{64} \text{ cu. ft.}$$

(8)... $2872\tfrac{17}{64}$ cu. ft. $= 4963275$ cu. in.

Contents of each brick $= 9$ in. $\times 4\tfrac{1}{2}$ in. $\times 3$ in. $= 121\tfrac{1}{2}$ cu. in.

No. of bricks in wall $= 4963275 \div 121\tfrac{1}{2} = 40850$

(9)...   Area of circle $= 12^2 \times \cdot 07958$

$$= 144 \text{ sq. in.} \times \cdot 07958$$

$$= 11 \cdot 45952 \text{ sq. in.}$$

Capacity of mug $= 11 \cdot 45952$ sq. in. $\times 6\tfrac{1}{2}$ in.

$$= 74 \cdot 48688 \text{ cu. in.}$$

$$= 1 \cdot 0745 \text{ quart}$$

(10)...The hexagonal base consists of six equilateral triangles, the side of each triangle measuring $7\frac{1}{2}$ feet

$$
\begin{array}{r}
7{\cdot}5 \\
3 \\
\hline
2)\overline{22{\cdot}5} \\
\hline
11{\cdot}25
\end{array}
\qquad
11{\cdot}25 - 7{\cdot}5 = 3{\cdot}75
$$

$$11{\cdot}25 \times 3{\cdot}75 \times 3{\cdot}75 \times 3{\cdot}75 = 593{\cdot}26171875$$

Area of each triangle $= \sqrt{593{\cdot}26171875} = 24{\cdot}356964$ sq. ft.

Area of base $= 24{\cdot}356964$ sq. ft. $\times 6 = 146{\cdot}141784$ sq. ft.

$$
\begin{aligned}
\text{Volume of pyramid} &= \tfrac{1}{3}(146{\cdot}141784 \text{ sq. ft.} \times 25 \text{ ft.}) \\
&= \tfrac{1}{3}(3653{\cdot}5446 \text{ cu. ft.}) \\
&= 1217{\cdot}8482 \text{ cu. ft.} \\
&= 1217 \text{ cu. ft. } 1465 \text{ cu. in.}
\end{aligned}
$$

EXERCISE XLVIII.

(1)... 60 sq. yds. 3 sq. ft. 18 sq. in. $= 543\frac{1}{8}$ sq. ft.

Breadth of room $= 543\frac{1}{8}$ sq. ft. $\div 27\frac{1}{2}$ ft.

$$= 19\tfrac{3}{4} \text{ ft.} = 19 \text{ ft. } 9 \text{ in.}$$

(2)...
$$
\begin{array}{r}
180 \\
255 \\
175 \\
250 \\
\hline
2)\overline{860} \\
\hline
430
\end{array}
\qquad
\begin{aligned}
430-180 &= 250 \\
430-255 &= 175 \\
430-175 &= 255 \\
430-250 &= 180
\end{aligned}
$$

$$250 \times 175 \times 255 \times 180 = 200812500$$

Area of figure $= \sqrt{200812500}$

$$= 44812 \text{ sq. yds.}$$

$$= 9 \text{ ac. } 1 \text{ ro. } 1 \text{ po. } 11\tfrac{3}{4} \text{ sq. yds.}$$

I I 2

(3)...   7 sq. ft. 16 sq. in. = 1024 sq. in.

Side of glass = $\sqrt{1024}$ = 32 in.

Outside measurement of frame = 32 in. + (4 in. × 2) = 40 in.

Area of frame = $(40)^2 - (32)^2$ = 1600 sq. in. − 1024 sq. in.

= 576 sq. in. = 4 sq. ft.

Cost of frame, 4 sq. ft. at 12*s.* per ft. = £2 8*s.*

(4)...   3 ro. 30 per. = $4537\frac{1}{2}$ yds.

Diameter = $\sqrt{(4537 \cdot 5 \times 2) \div \cdot 7854}$

= $\sqrt{9075 \div \cdot 7854}$

= $\sqrt{11554 \cdot 621848}$

= 107·492 yds.

Length of arc = $\frac{1}{2}$(107·492 yds. × 3·1416)

= $\frac{1}{2}$(337·6968672 yds.)

= 168·8484336 yds.

Length of railing required

= 107·492 yds. + 168·848 yds. = 276·34 yds.

(5)...   Surface of sphere = $(2\cdot25)^2 \times 3\cdot1416$

= 5·0625 sq. ft. × 3·1416

= 15·90435 sq. ft.

(6)...The extremity of the hour-hand moves $(5\frac{1}{4}$ in. $\times 2) \times 3\frac{1}{7}$
= 33 inches in 12 hours.

The extremity of the minute-hand moves (7 in. $\times 2) \times 3\frac{1}{7}$
= 44 inches in 1 hour, and 528 inches in 12 hours.

Hence, the ratio of their movements is

$$\text{as } 33 \quad : \quad 528$$
$$\text{or, as } 1 \quad : \quad 16$$

(7)...Area of bottom of cistern = 75 in. $\times 52$ in. = 3900 sq. in.

$277\frac{1}{4}$ cu. in. $\times 450 = 124762\frac{1}{2}$ cu. in.

Required depth = $124762\frac{1}{2}$ cu. in. $\div 3900$ sq. in. = 31·99 in.

(8)...Transverse diameter of outer ellipse

= 45 yds. + (8 ft. $\times 2$) = 151 ft.

Conjugate diameter = 28 yds. + (8 ft. $\times 2$) = 100 ft.

Area of outer ellipse = 151 ft. $\times 100$ ft. $\times$ ·7854

= 15100 sq. ft. $\times$ ·7854

= 11859·54 sq. ft.

Area of inner ellipse = 135 ft. $\times 84$ ft. $\times$ ·7854

= 11340 sq. ft. $\times$ ·7854

= 8906·436 sq. ft.

Area of walk = 11859·54 sq. ft. — 8906·436 sq. ft.

= 2953·104 sq. ft.

Gravel required = 2953·104 sq. ft. $\times \frac{1}{4}$ ft.

= 738·276 cu. ft.

= 27·3435 cu. yds.

(9)...   Area of section of column $= (1\frac{1}{2})^2 \times \cdot7854$ (ft.)

$$= 2\frac{1}{4} \text{ sq. ft.} \times \cdot7854$$

$$= 1\cdot76715 \text{ sq. ft.}$$

Solidity of column $= 1\cdot76715$ sq. ft. $\times 36$ ft.

$$= 63\cdot6174 \text{ cu. ft.}$$

1 cu. ft. of the marble weighs 2700 oz.

cu. ft.		cu. ft.		oz.		oz.
1	:	63·6174	::	2700	:	171766·98

171766·98 oz. $= 4$ tons 15 cwt. 3 qrs. 11 lb. 6·98 oz.

(10)...   Inside measurement, length of box $= 20$ in.

breadth   „ $= 14$ in.

depth   „ $= 12$ in.

Gunpowder, 20 in. $\times 14$ in. $\times 12$ in. $= 3360$ cu. in.

1 cu. ft. of gunpowder weighs 932 oz.

cu. in.		cu. in.		oz.		oz.
1728	:	3360	::	932	:	$1812\frac{2}{9}$, gunpowder

Wood in box $= (22 \times 16 \times 14) - (20 \times 14 \times 12)$ (in. in. in. in. in. in.)

$$= 4928 \text{ cu. in.} - 3360 \text{ cu. in.} = 1568 \text{ cu. in.}$$

1 cu. ft. of oak weighs 925 oz.

cu. in.		cu. in.		oz.		oz.
1728	:	1568	::	925	:	$839\frac{19}{54}$, oak

Weight of box $=$ $839\frac{19}{54}$ oz.
Weight of gunpowder $= 1812\frac{2}{9}$ oz.
Gross weight $= \overline{2652\frac{31}{54}}$ oz. $= 165$ lb. $12\frac{31}{54}$ oz.

EXERCISE XLIX.

(1)...Perimeter of room $= (22\frac{1}{2}$ ft. $+ 18$ ft.$) \times 2 = 81$ ft.

Area of walls $= 81$ ft. $\times 11$ ft. $= 891$ sq. ft.

Door .... $7\frac{1}{2}$ ft. $\times 3\frac{5}{6}$ ft. $= 28\frac{3}{4}$ sq. ft.
2 windows, each... 6 ft. $\times 3\frac{2}{3}$ ft. $= 44$ „
Fireplace .... 5 ft. $\times 5$ ft. $= 25$ „
Skirting-board ...$72\frac{1}{6}$ ft. $\times$ $\frac{1}{2}$ ft. $= \underline{36\frac{1}{12}}$ „
$\overline{133\frac{5}{6}}$ sq. ft.

Area to be papered $= 891$ sq. ft. $- 133\frac{5}{6}$ sq. ft.

$\quad\quad = 757\frac{1}{6}$ sq. ft.

$\quad\quad = 84$ sq. yds. 1 sq. ft. 24 sq. in.

(2)...Area of garden $= 40$ yds. $\times 40$ yds. $= 1600$ sq. yds.

2 paths, each 120 ft. $\times 4$ ft. $= 960$ sq. ft.
2 paths, each 112 ft. $\times 5$ ft. $= 1120$ „
1 path ....112 ft. $\times 6$ ft. $= 672$ „
1 path ....104 ft. $\times 6$ ft. $= \underline{624}$ „
$9)\overline{3376}$
$\overline{375}$ sq. yds. 1 sq. ft.

1600 sq. yds. $- 375$ sq. yds. 1 sq. ft. $= 1224$ sq. yds. 8 sq. ft.

(3)... $ab = \sqrt{2(16)^2 + 1}$ ft.

$\quad = \sqrt{512} + 1$ ft.

$\quad = 22{\cdot}6274$ ft. $+ 1$ ft.

$\quad = 23{\cdot}6274$ ft.
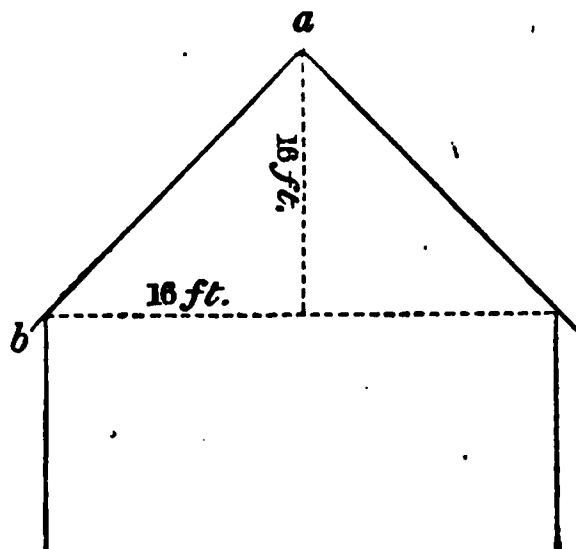
Area of roof $= 23{\cdot}6274$ ft. $\times 44$ ft. $\times 2$

$\quad\quad = 1039{\cdot}6056$ sq. ft. $\times 2$

$\quad\quad = 2079{\cdot}2112$ sq. ft.

(4)... The arc of the semicircle $= \frac{11}{7}$ of the diameter

$$\frac{11}{7} + 1 = \frac{18}{7}$$

$$\overset{}{\frac{18}{7}} \quad : \quad 1 \quad :: \quad \overset{\text{yds.}}{324} \quad : \quad \overset{\text{yds.}}{126}, \text{ diameter}$$

$$
\begin{aligned}
\text{Area of plantation} &= \tfrac{1}{2}\{(\overset{\text{yds.}}{126})^2 \times \cdot 7854\} \\
&= \tfrac{1}{2}(15876 \text{ sq. yds.} \times \cdot 7854) \\
&= \tfrac{1}{2}(12469 \cdot 0104 \text{ sq. yds.}) \\
&= 6234 \cdot 5052 \text{ sq. yds.} \\
&= 1 \text{ ac. } 1 \text{ ro. } 6 \text{ per. } 3 \text{ sq. yds.}
\end{aligned}
$$

(5)...
$$
\begin{aligned}
\text{Surface of hill} &= \tfrac{1}{2}(150 \text{ yds.} \times 50 \text{ ft.}) \\
&= \tfrac{1}{2}(450 \text{ ft.} \times 50 \text{ ft.}) \\
&= \tfrac{1}{2}(22500 \text{ sq. ft.}) \\
&= 11250 \text{ sq. ft.} \\
&= 1250 \text{ sq. yds.}
\end{aligned}
$$

(6)...The areas of circles are to one another as the squares of their diameters.

$$
\overset{\text{la. \ da. \ ho.}}{2 \times 45 \times 10} \quad : \quad \overset{\text{la. \ da. \ ho.}}{3 \times x \times 9} \quad :: \quad \overset{\text{fa.}}{5^2 \times 60} \quad : \quad \overset{\text{fa.}}{8^2 \times 75}
$$

$$
x = \frac{2 \times \cancel{45} \times 10 \times \cancel{64} \times \cancel{75}}{\cancel{3} \times \cancel{9} \times \cancel{25} \times \cancel{60}} = \frac{320}{3} \text{ da.} = 106\tfrac{2}{3} \text{ da.}
$$

(7)...
$$
\overset{\text{in.}}{8^2 \times 6\tfrac{3}{4}} \quad : \quad \overset{\text{in.}}{(4\tfrac{1}{2})^2 \times 8} \quad :: \quad \overset{\text{lb.}}{1} \quad : \quad \overset{\text{lb.}}{x}
$$

$$
\begin{aligned}
x &= (20\tfrac{1}{4} \times 8) \div (9 \times 6\tfrac{3}{4}) \\
&= \frac{\cancel{81}}{\cancel{4}} \times \frac{8}{1} \times \frac{1}{\cancel{9}} \times \frac{\cancel{4}}{\cancel{27}} = \frac{8}{3} \text{ lb.} = 2 \text{ lb. } 10\tfrac{2}{3} \text{ oz.}
\end{aligned}
$$

(8)...   1 gallon $= 34\frac{2}{3}$ cu. in. $\times 8 = 277\frac{1}{3}$ cu. in.

6 ft. 3 in. $\times$ 3 ft. 4 in. $\times$ 2 ft. 3 in. $= 75$ in. $\times 40$ in. $\times 27$ in.

$$= 81000 \text{ cu. in.}$$

$$81000 \div 277\frac{1}{3} = 292\frac{7}{104} \text{ gal.}$$

(9)...   Silk in balloon $= \overset{\text{ft.}}{(35)^2} \times 3\cdot1416$

$$= 1225 \text{ sq. ft.} \times 3\cdot1416$$

$$= 3848\cdot46 \text{ sq. ft.}$$

$$= 427\cdot60\dot{6} \text{ sq. yds.}$$

Gas required $= \overset{\text{ft.}}{(35)^3} \times \cdot5236$

$$= 42875 \text{ cu. ft.} \times \cdot5236$$

$$= 22449\cdot35 \text{ cu. ft.}$$

(10)... $\overset{\text{mi.}}{2^2 \times 1}$: $\overset{\text{mi.}}{4^2 \times 15}$ :: $\overset{\text{gal.}}{20}$: $\overset{\text{gal.}}{x}$

$$x = \frac{\overset{4}{\cancel{16}} \times 15 \times 20}{\cancel{4}} = 1200 \text{ gal.}$$

EXERCISE L.

(1)...Area of field $= 125$ yds. $\times 108$ yds. $= 13500$ sq. yds.

Area of each plantation $= \frac{1}{2}(2\dot{0}$ yds. $\times 20$ yds.)

$$= \frac{1}{2}(400 \text{ sq. yds.})$$

$$= 200 \text{ sq. yds.}$$

13500 sq. yds. $- (200$ sq. yds. $\times 4)$

$$= 13500 \text{ sq. yds.} - 800 \text{ sq. yds.}$$

$$= 12700 \text{ sq. yds.}$$

$$= 2 \text{ ac. } 2 \text{ ro. } 19 \text{ po. } 25\frac{1}{4} \text{ sq. yds.}$$

(2)... $\frac{11}{20}$ of a mile $=$ 968 yds.

Area of two footways $=$ 968 yds. $\times$ 7 yds.

$=$ 6776 sq. yds.

Area of carriage-way $=$ 968 yds. $\times$ 11 yds.

$=$ 10648 sq. yds.

$$
\begin{array}{lr}
 & £ \quad s. \\
\text{6776 sq. yds. at 3}s.\ 6d.\ \text{per yd.} = 1185 \quad 16 \\
\text{10648 sq. yds. at 2}s.\ 3d.\ \text{per yd.} = 1197 \quad 18 \\
\hline
£2383 \quad 14s.
\end{array}
$$

(3)...

$2\frac{1}{2}$ miles $=$ 4400 yards.

$$
\begin{array}{ll}
\quad 2850 & 5350 - 2850 = 2500 \\
\quad 3450 & 5350 - 3450 = 1900 \\
\quad 4400 & 5350 - 4400 = 950 \\
2\overline{)10700} & \\
\quad \overline{5350} &
\end{array}
$$

5350 × 2500 × 1900 × 950 $=$ 24141875000000

Area of triangle ABC $=$ $\cdot\sqrt{24141875000000}$
$=$ 4913438·2 sq. yds.

$$\begin{array}{r} 3730 \\ 2870 \\ 4400 \\ \hline 2)\overline{11000} \\ \hline 5500 \end{array}$$

$$\begin{array}{l} 5500-3730 = 1770 \\ .5500-2870 = 2630 \\ 5500-4400 = 1100 \end{array}$$

$$5500 \times 1700 \times 2630 \times 1100 = 28163355000000$$

Area of triangle ADC $= \sqrt{28163355000000}$
$= 5306915\cdot7$ sq. yds.

$$\begin{array}{r} 4913438\cdot2 \\ 5306915\cdot7 \\ \hline \end{array}$$

Area of park $= \overline{10220353\cdot9}$ sq. yds.

$\qquad = 2111$ ac. 2 ro. 22 po. 28 sq. yds.

(4)... Transverse diameter of outer ellipse ·
$= 16$ ft. $+ (2\text{ft.} \times 2) + (3\frac{1}{2}$ ft. $\times 2) = 27$ ft.

Ditto of middle ellipse $= 16$ ft. $+ (2$ ft. $\times 2) = 20$ ft.

Conjugate diameter of outer ellipse
$= 9$ ft. $+ (2$ ft. $\times 2) + (3\frac{1}{2}$ ft. $\times 2) = 20$ ft.

Ditto of middle ellipse $= 9$ ft. $+ (2$ ft. $\times 2) = 13$ ft.

Area of outer ellipse $= 27$ ft. $\times 20$ ft. $\times \cdot7854$
$= 540$ sq. ft. $\times \cdot7854$
$= 424\cdot116$ sq. ft.

Area of middle ellipse $= 20$ ft. $\times 13$ ft. $\times \cdot7854$
$= 260$ sq. ft. $\times \cdot7854$
$= 204\cdot204$ sq. ft.

Area of flower-bed $= 16$ ft. $\times 9$ ft. $\times \cdot7854$
$= 144$ sq. ft. $\times \cdot7854$
$= 113\cdot0976$ sq. ft.

Area of grass border $= 204\cdot204$ sq. ft. $- 113\cdot0976$ sq. ft.
$= 91\cdot1064$ sq. ft.

Area of gravel walk $= 424\cdot116$ sq. ft. $- 204\cdot204$ sq. ft.
$= 219\cdot912$ sq. ft.
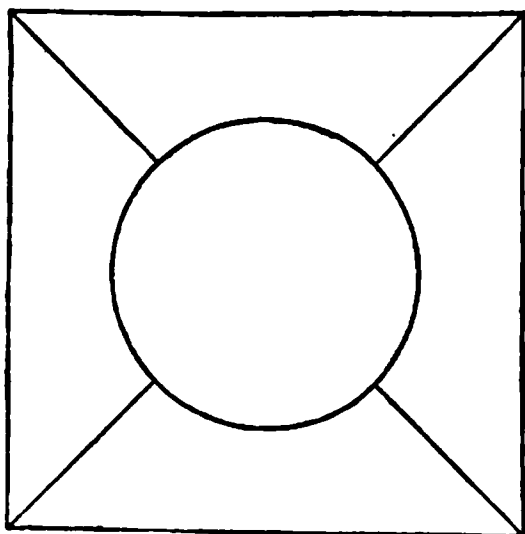
(5)... 5 acres $= 24200$ sq. yds.

Diagonal of square $= \sqrt{24200 \times 2}$

$$= \sqrt{48400}$$

$$= 220 \text{ yds.}$$

1 ac. 1 ro. 20 per. $= 6655$ sq. yds.

Diameter of circle $= \sqrt{6655 \div \cdot 7854}$

$$= \sqrt{8473 \cdot 38935574}$$

$$= 92 \cdot 051 \text{ yds.}$$

Length of each path $= \frac{1}{2}(220 \text{ yds.} - 92 \cdot 051 \text{ yds.})$

$$= \frac{1}{2}(127 \cdot 949 \text{ yds.})$$

$$= 63 \cdot 9745 \text{ yds.}$$

(6)... Circumference of circle $= (15\frac{3}{4} \text{ ft.} \times 2) \times 3\frac{1}{7}$

$$= 31\frac{1}{2} \text{ ft.} \times 3\frac{1}{7}$$

$$= 99 \text{ ft.} = 33 \text{ yds.}$$

Distance walked in 5 minutes $= 33 \text{ yds.} \times 21$

$$= 693 \text{ yds.}$$

Distance walked in 1 hour $= 8316$ yds

8316 yds. $= 4$ miles, 5 furlongs, 32 poles

(7)... Contents of mahogany top $= 8\frac{1}{2} \text{ ft.} \times 4\frac{1}{6} \text{ ft.} \times \frac{5}{48} \text{ ft.}$

$$= 3\frac{397}{576} \text{ cu. ft.}$$

cu. ft.		cu. ft.		lb.		lb.
34	:	$3\frac{397}{576}$	::	2240	:	$243\frac{1}{18}$

Contents of oak top $= 9 \text{ ft.} \times 3\frac{2}{3} \text{ ft.} \times \frac{1}{8} \text{ ft.} = 4\frac{1}{8}$ cu. ft.

$$\begin{array}{cccc} \text{cu. ft.} & \text{cu. ft.} & \text{lb.} & \text{lb.} \\ 39 & : \quad 4\frac{1}{8} & :: \quad 2240 & : \quad 236\frac{12}{13} \end{array}$$

Weight of mahogany top $243\frac{1}{18}$ lb.

Ditto of oak top............ $236\frac{12}{13}$

The mahogany top weighs $\overline{6\frac{31}{234}}$ lb. heavier than the oak top

(8)... Quantity of clay $= 20$ ft. $\times 9$ ft. $\times 6$ ft. $= 1080$ cu. ft.

Ditto, when compressed $= 1080 - \frac{1}{9}(1080) = 960$ cu. ft.

$$= 1658880 \text{ cu. in.}$$

Area of interior ellipse $= 6$ in. $\times 4$ in. $\times \cdot 7854$

$$= 24 \text{ sq. in.} \times \cdot 7854$$

Area of exterior ellipse $= 8$ in. $\times 6$ in. $\times \cdot 7854$

$$= 48 \text{ sq. in.} \times \cdot 7854$$

Area of oval ring $= (48 - 24) \times \cdot 7854$

$$= 24 \text{ sq. in.} \times \cdot 7854$$

$$= 18 \cdot 8496 \text{ sq. in.}$$

Length of pipe $= 1658880$ cu. in. $\div 18 \cdot 8496$ sq. in.

$$= 88006 \cdot 1115 \text{ in.}$$

$$= 2444 \cdot 6142 \text{ yds.}$$

(9)...
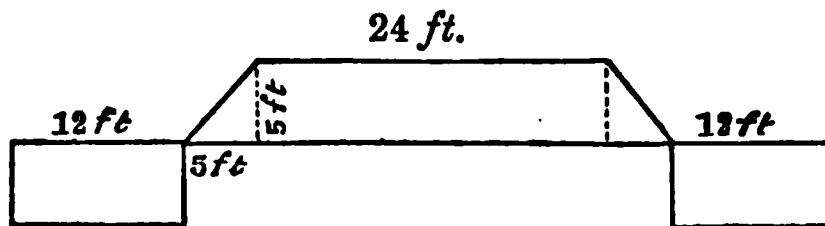
SECTION OF EMBANKMENT AND TRENCHES.

Mean width of embankment $= \frac{1}{2}(24 + 34) = 29$ ft.

Area of section of embankment $= 29$ ft. $\times 5$ ft. $= 145$ sq. ft.

Required depth of trenches $= 145$ sq. ft. $\div (12$ ft. $\times 2)$

$$= 145 \text{ sq. ft.} \div 24 \text{ ft.}$$

$$= 6\frac{1}{24} \text{ ft.}$$

(10)...   Quantity of silk in balloon $= (35)^2 \times 3\cdot1416$

$$= 1225 \text{ sq. ft.} \times 3\cdot1416$$

$$= 3848\cdot46 \text{ sq. ft.}$$

$$= 427\cdot60\dot{6} \text{ sq. yds.}$$

Weight of silk $= 2\frac{3}{4}$ oz. $\times 427\cdot60\dot{6} = 1175\cdot918\dot{3}$ oz.

Quantity of gas $= (35)^3 \times \cdot5236$

$$= 42875 \text{ cu. ft.} \times \cdot5236$$

$$= 22449\cdot35 \text{ cu. ft.}$$

Weight of atmospheric air displaced by balloon

$$= 1\frac{1}{4} \text{ oz.} \times 22449\cdot35$$

$$= 28061\cdot6875 \text{ oz.}$$

Hence, the weight of the gas in the balloon

$$= 28061\cdot6875 \text{ oz.} \times \cdot069 = 1936\cdot2564375 \text{ oz.}$$

oz.
$$
\begin{aligned}
\text{Weight of silk} &= 1175\cdot918\dot{3} \\
\text{Weight of gas} &= 1936\cdot2564 \\
\hline
\text{Weight of balloon when filled} &= 3112\cdot1747 \text{ oz.}
\end{aligned}
$$

oz.
$$
\begin{aligned}
\text{Weight of equal bulk of air} &= 28061\cdot6875 \\
&\quad\ \ 3112\cdot1747 \\
\hline
\text{Weight required to balance balloon} &= 24949\cdot5128 \text{ oz.}
\end{aligned}
$$

24949·5 oz. $= 13$ cwt. 3 qrs. 19 lb. $5\frac{1}{2}$ oz.

OPINIONS

OF

THE PRESS AND THE PROFESSION.

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' Contains 2,000 original Examples, arranged in sets of exercises, graduated as to difficulty. This book is admirably adapted for examination purposes. The Examples, besides being numerous, are varied and good— so good, that we are afraid Mr. Harris will, in regard to this, as in his " Questions in Arithmetic," think himself entitled to complain of various Examination Papers being stocked with his Examples. His books could not have a better recommendation.'— *The Museum and English Journal of Education.*

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